MODERN PLASTICS

AUGUST 1955

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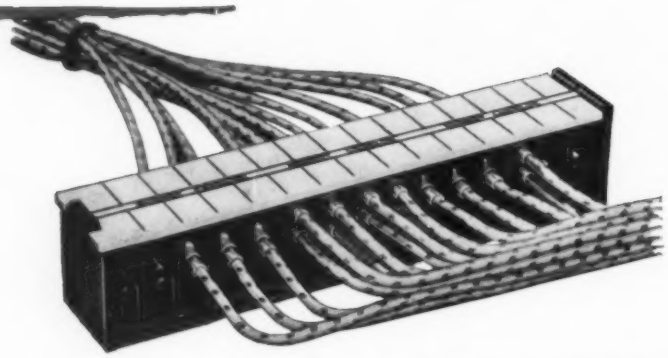

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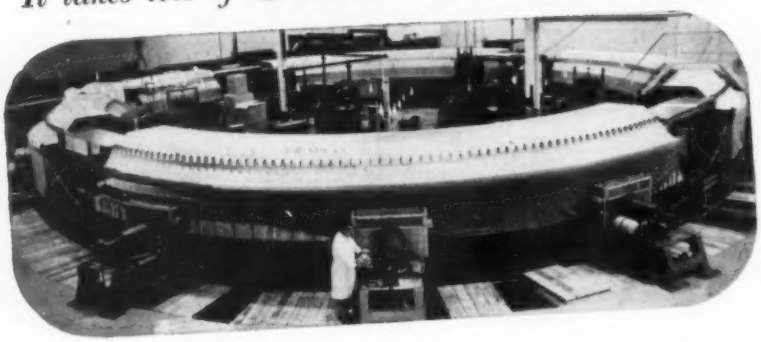

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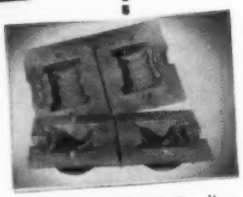

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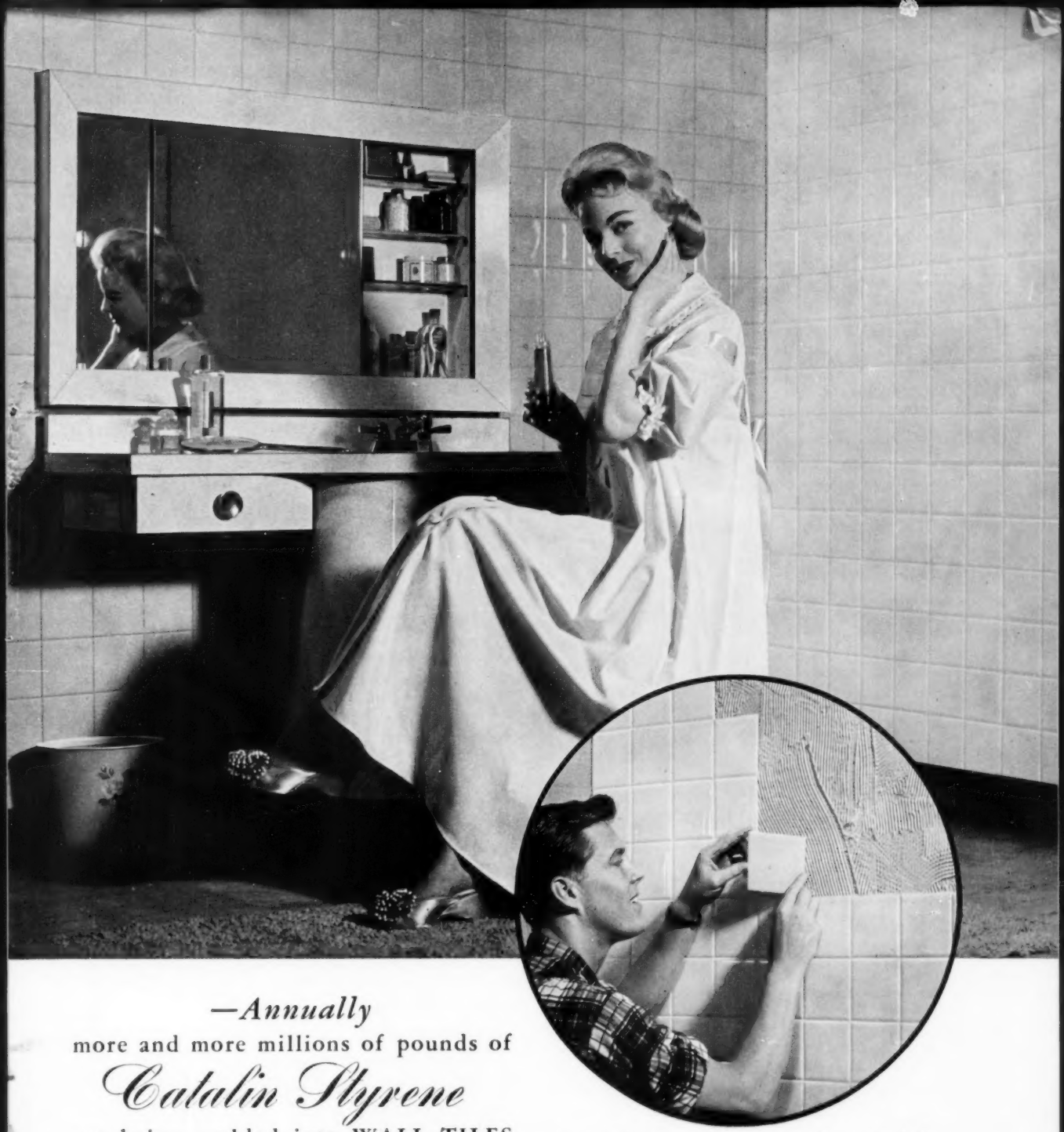

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August 1955 • Vol. 32, No. 12

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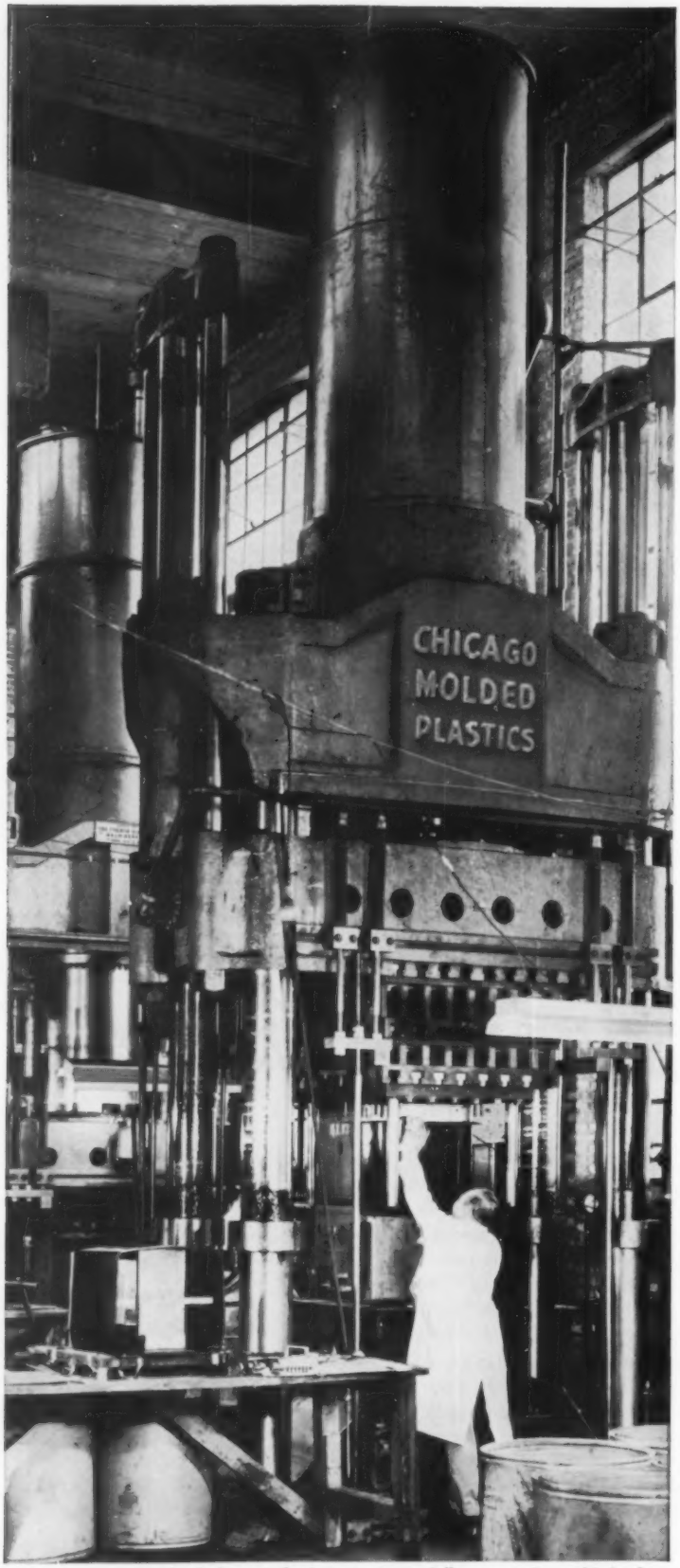

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EDITORIAL

End-Product Standards for Vinyl

The vinyl film materials standards established through the National Bureau of Standards under the auspices of The Society of the Plastics Industry, Inc., in May 1953, have proved effective in building better markets for better quality vinyl products. Not the least salutory effect in the process of using the standards to promote a bigger business in vinyl film was the educational and public relations program engaged in by the industry.

Now comes the second step: two years later, an End-Product Standards Committee has been set up by the S.P.I. to study ways to develop minimum standards for finished products made of vinyl film which complies with the film standards established in 1953.

In these days of prepackage merchandising, of impulse display, and informative labeling it is especially important that the public receive assurance that a product which may be made in a number of different ways and whose endurance properties may not be apparent at time of purchase, shall have been constructed to at least a minimum standard.

Plastics proprietary products are sold through a tremendous variety of retail outlets and only the largest of these organizations can afford testing laboratories. Indeed, even many fabricators of film products are too small to engage in constant testing exercises.

Yet all retailers must be able to assure their customers that the products they sell will be durable in proportion to price. This is part of the pattern of "trading up" to better merchandise.

The current end-product standards development program embraces rainwear, closet accessories, inflatables, and a fourth category which will encompass shower curtains, cottage sets, tablecloths, draperies, etc. Discussion so far has centered around possible procedures and the development of a seal of quality for finished vinyl film products similar to the seal created for the films themselves and extending the usefulness of the latter.

It must be pointed out that the best way to make a standard effective at retail and consumer levels is for the individual manufacturer of film, and the individual fabricator, to exceed the minimum in quality and to promote that fact vigorously.

It must also be pointed out that time is a most important element in successful promotion of this or almost any other program. While the total market for vinyl increased in 1954 over 1953 by about 27 million pounds, sales of film products dropped by at least four million pounds. But while sales of film products were slipping at retail, the promotion of the use of the standards was proceeding—with the result that every indication shows that film sales for the first six months of the current year have been much improved.

The improvement has been partly accomplished by the vigorous promotion of the film standards—which took time to show results.

It is hoped that the development of end-product standards will enhance this trend. But let no one expect any overnight miracles. All the industry has done is to lay a promotional and merchandising foundation based on integrity of purpose. Fortunately, all levels of the industry, from resin makers through calenderers and fabricators to retailers, are most enthusiastically concerned.

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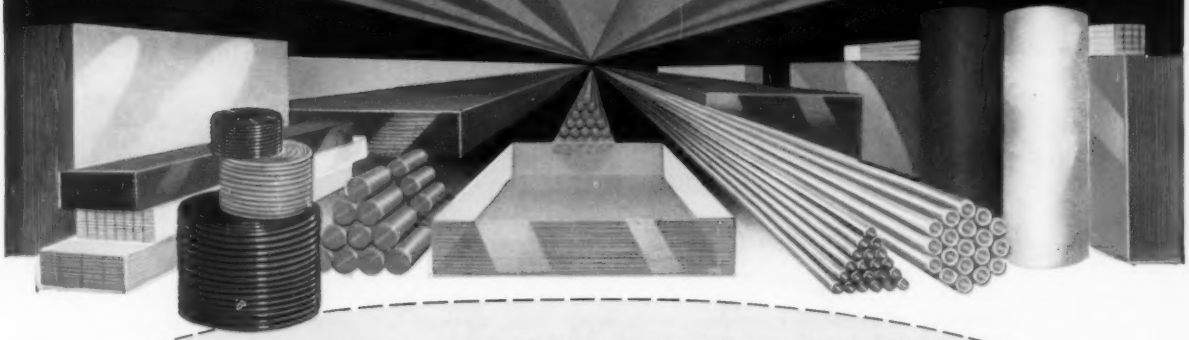

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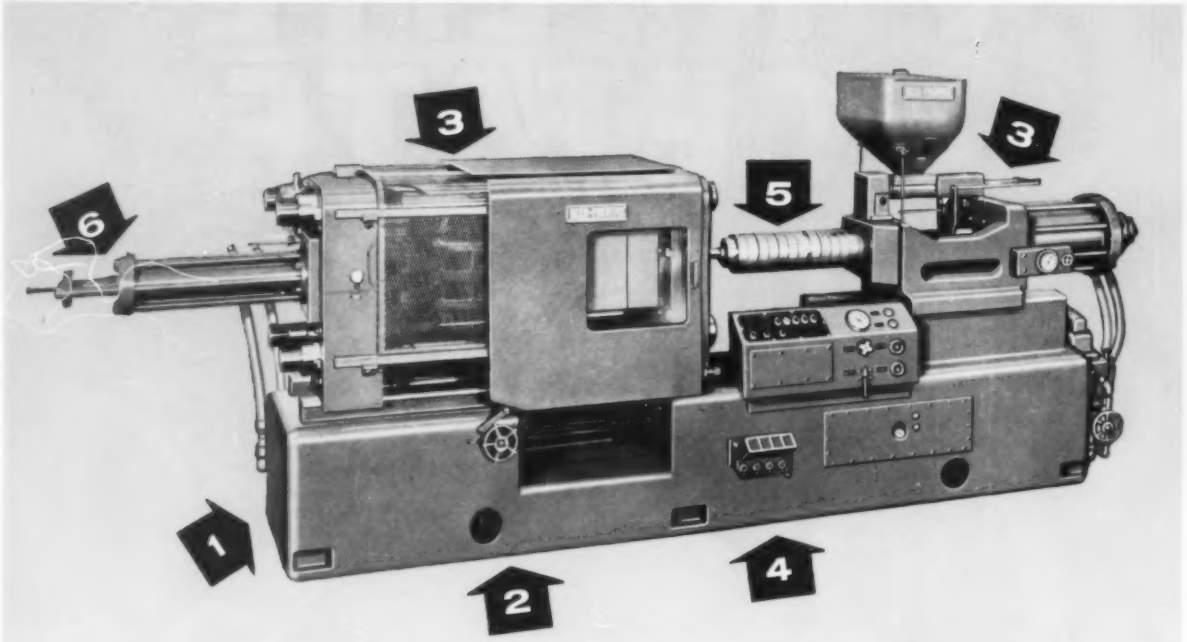

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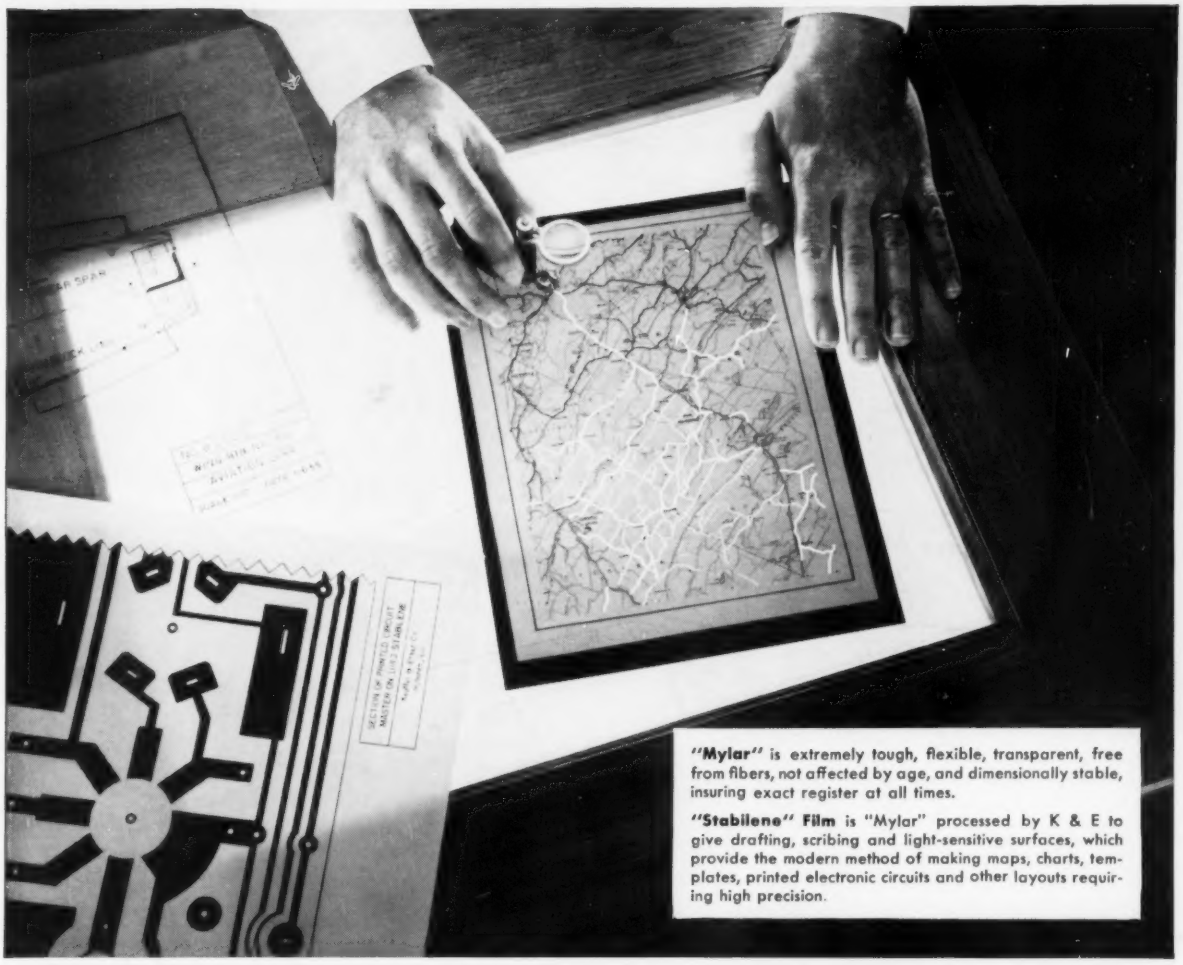

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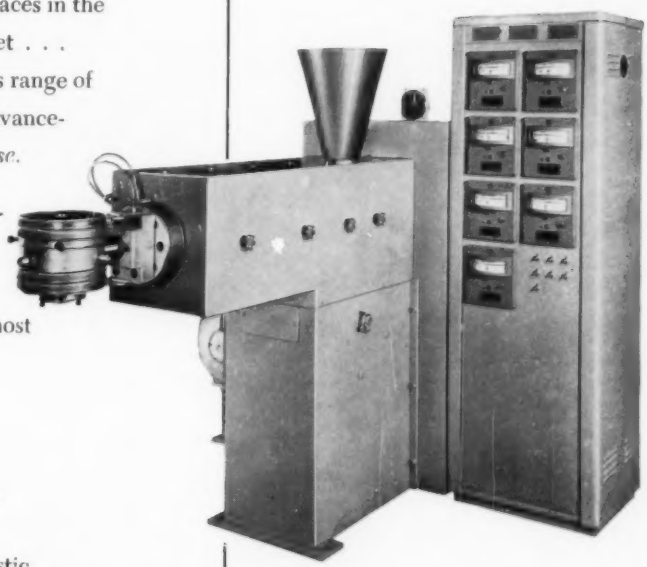
We can... because they all have purchased MPM extruders!

Take the common thermoplastics—polyethylene, styrene, vinyl chloride, cellulose acetate; take the uncommon ones—vinyl formal, vinyl butyral, the fluorothenes; take those that are still being put through their paces in the laboratories and that haven't even been named yet . . . and you will begin to get an idea of the enormous range of materials that are being extruded on the same advance-design MPM extruders you can buy for *your own use.*



As a direct outgrowth of MPM's superior heating and cooling system, temperature control, screw speed control, and corrosion-resistant construction, thirty-three of the country's foremost manufacturers of thermoplastics have chosen them for *their own use.*

What do they use them for? For spot-checking current production; for color blending; for development work on behalf of their customers; for extruding experimental thermoplastic compounds.

The very fact that MPM extruders are so popular with so many resin suppliers is conclusive proof that they rate "tops" for versatility and reliable performance. We will gladly send you details. Write today.

modern plastic machinery corp.

15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

West Coast Representative:
4113 W. Jefferson St., Los Angeles 16, Calif.

PLIOVIC...another quality product of Goodyear Chemical Division

SUN + SALT = NEW USE

for sheeting made with PLIOVIC

HOT SUN, salt spray and hard usage raise havoc with the upholstery on pleasure craft.

But the sparkling white upholstery on the runabout shown at right has weathered two seasons with no sign of wear, color change, cracking, tearing or tackiness – has completely kept its original beauty. It whisks clean with a damp cloth, stays surprisingly cool in the sun.

This upholstery is made of PLIOVIC in the form of heavy-duty sheeting. PLIOVIC is the family name for a series of polyvinyl chloride resins whose particle size, shape and distribution are carefully controlled.

This precise particle control means easy handling, easy processing–reduced manufacturing costs. And it means superior service life because the product acquires a shorter heat history resulting in greater heat and light stability, less degradation of physical properties.

Many manufacturers have turned to PLIOVIC to help them build a better product, faster, at lower cost. For example, one manufacturer reports PLIOVIC permits 25% faster calendering with no streaking or loss of gloss. And he now uses larger Banbury batches. Another firm reports greater freedom from gel particles since using PLIOVIC. Still another tells of better dry blending characteristics with PLIOVIC.

If you have a problem product – or are developing something new under the sun – perhaps PLIOVIC can help you. For details, samples and full technical help on its use, write to:

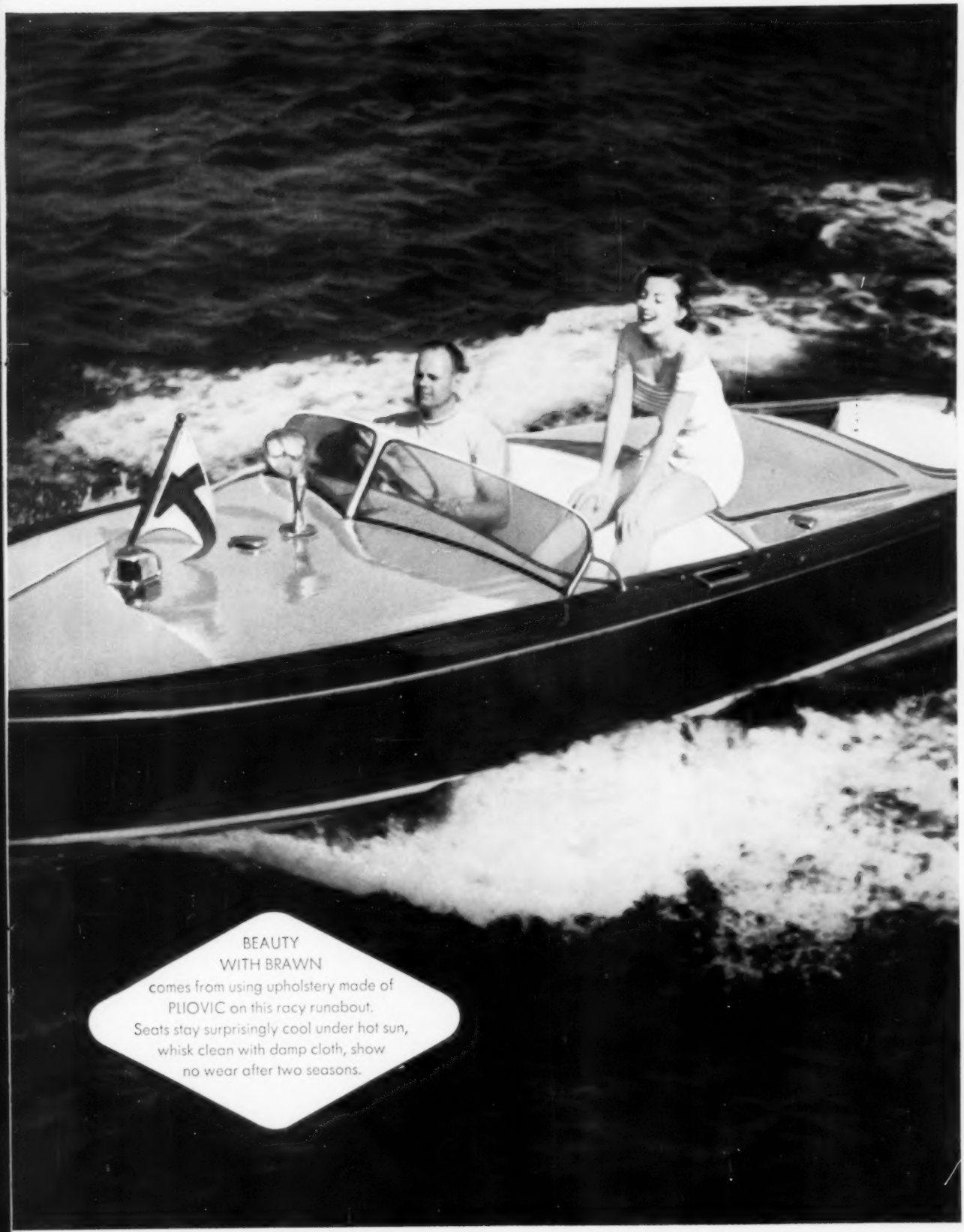
Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL GOODYEAR DIVISION

Chemigum, Pliobond, Plioflex, Pliolite, Plio-Tuf, Pliovic–T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

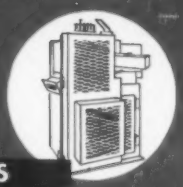
The Finest Chemicals for Industry — CHEMIGUM • PLIOBOND • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS

PLIOVIC...another quality product of Goodyear Chemical Division


BEAUTY
WITH BRAWN
comes from using upholstery made of
PLIOVIC on this racy runabout.
Seats stay surprisingly cool under hot sun,
whisk clean with damp cloth, show
no wear after two seasons.

In Plastics Reducing Machinery, Look to CUMBERLAND for the COMPLETE LINE

GRANULATORS



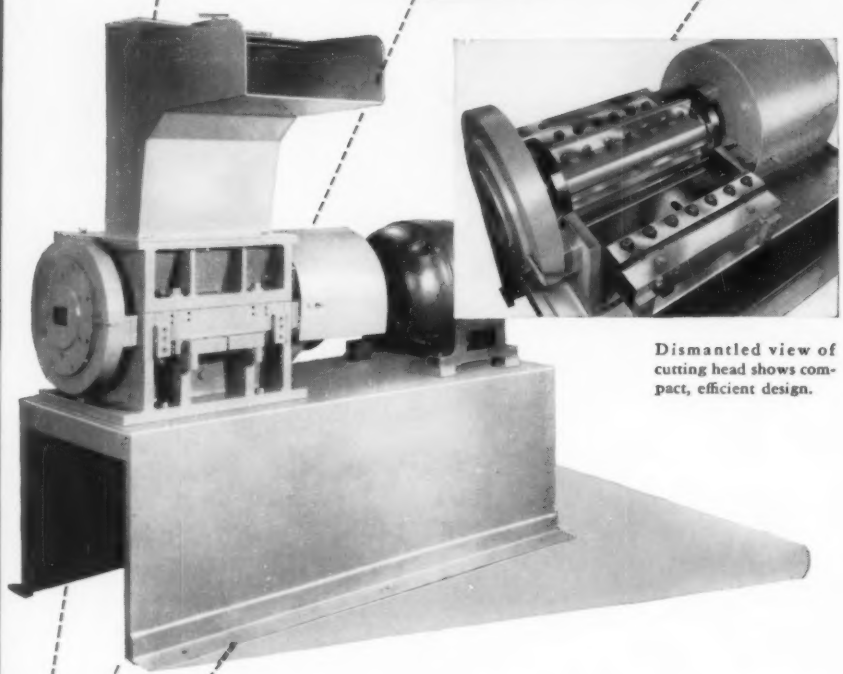
DICERS

CHOPPERS

PREBREAKERS

MODEL 20 All Steel Granulator

CUSTOM ENGINEERED QUALITY BUILT



Dismantled view of cutting head shows compact, efficient design.

1 HEAVY DUTY — Large flywheel—thick all-steel weldments—deep welds—parts are of flawless wrought steel (not steel castings)—machine resists wreckage.

2 LARGE THROAT OPENING — 8 by 20″ size.

3 PRIOR BANDSAWING NOT NEEDED — Machine specially built to handle large chunky parts such as bleeder scrap, cylinder purgings and heavy cast slabs of polystyrene, modified polystyrene and acrylic resins.

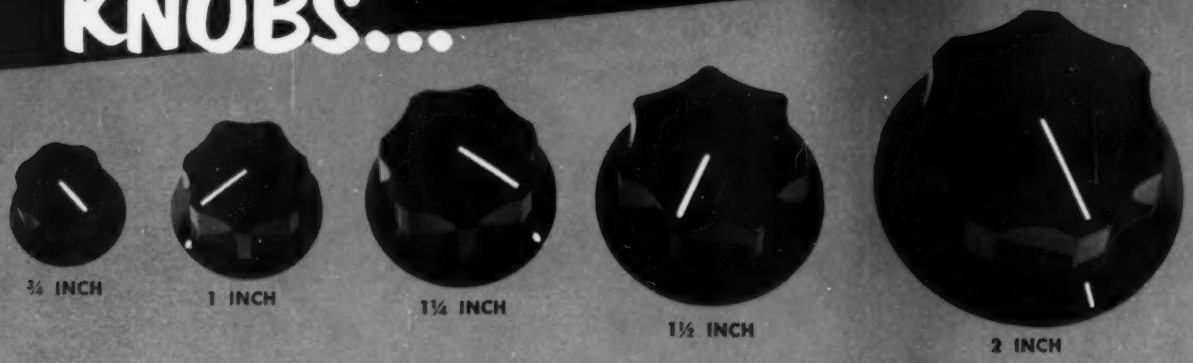
CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

DEPT. 1 • BOX 216 • PROVIDENCE • RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4113 West Jefferson Blvd., Los Angeles 16, Cal.

KNOBS...

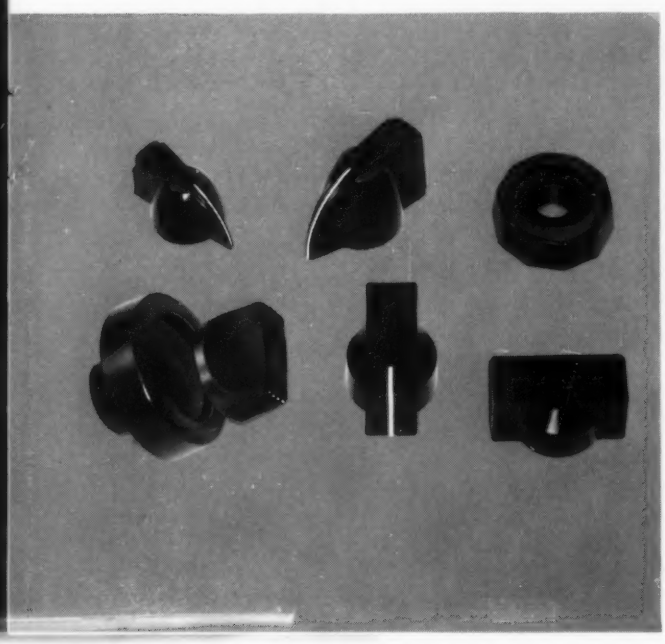


A New All-purpose Functional Design In a Standard Line of Instrument Knobs

Now, without tooling charge of your own, you can dress up your instrument line with these beautifully designed, readily available knobs by Kurz-Kasch.

Look them over! Shown actual size, dimensions given are flange diameters. All sizes have ¼" shaft holes—come with or without brass inserts—any type of setscrew (one or more). Undersides are counterbored. Color, metalized, and filled or unfilled indicator lines at your option. Here's style at a price!

Turn to Kurz-Kasch for the most complete line of standard knobs in the industry—and SAVE. Send for samples and specification data today—or request full line data on knobs not shown. Inquiries answered at once.

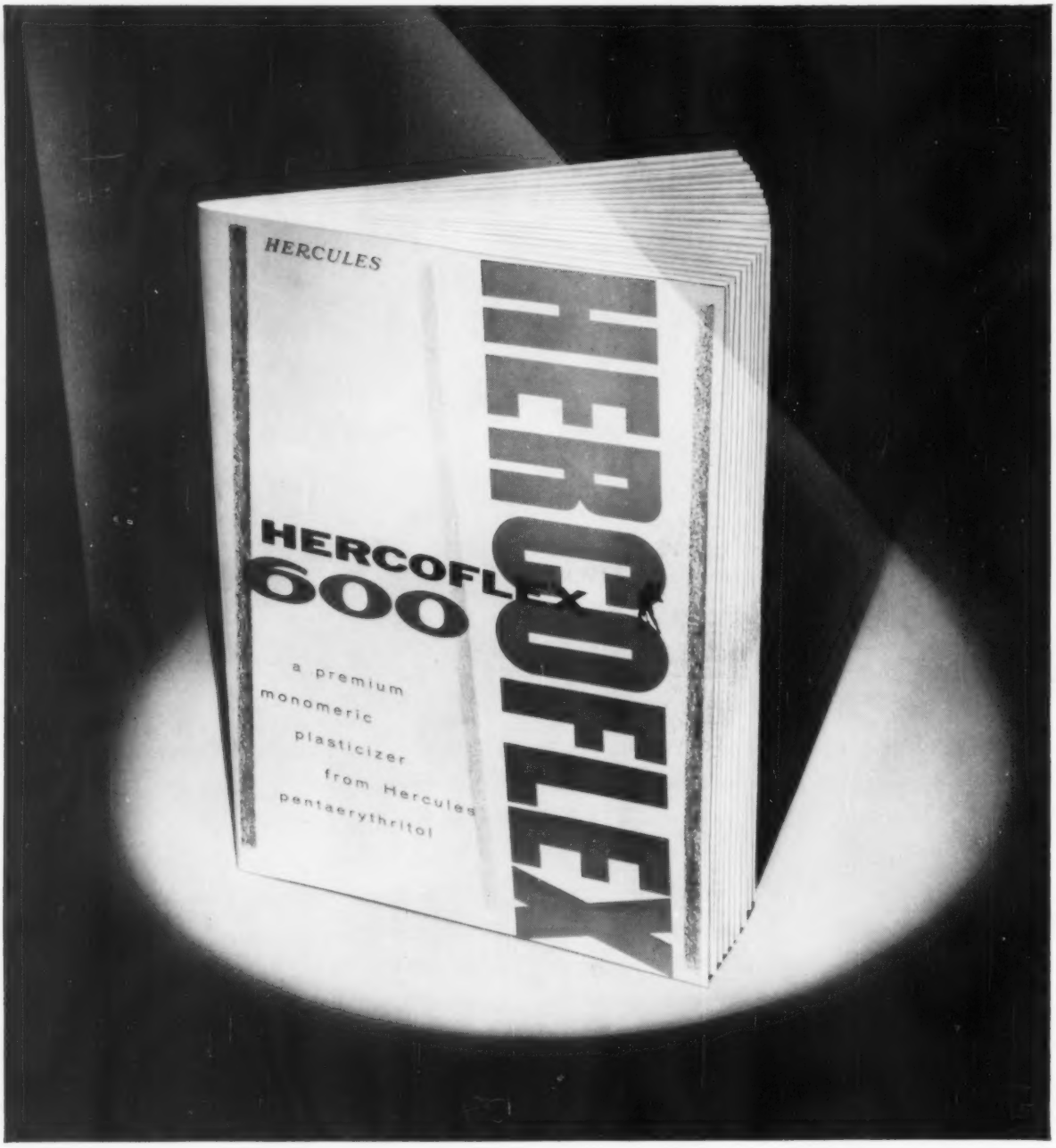


Don't overlook these popular Kurz-Kasch designs for bar knobs, pointer knobs and dual control vernier knobs.

KURZ-KASCH

Specialists in Thermo-Setting Plastics for 37 years

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio
BRANCH SALES OFFICES: New York, *Mt. Vernon MO 4-4866* • Rochester, *E. Rochester 941* • Chicago, *Merrimac 7-1830* • Detroit, *Jordan 6-0743* • Philadelphia, *Hilltop 6-6472* • Dallas, *Logan 5234* • Los Angeles, *Richmond 7-5384* • St. Louis, *Parkview 5-9577* • Atlanta, *Exchange 0414* • Toronto, *Riverdale 3511*.
EXPORT OFFICE: 89 Broad St., New York City, *Bowling Green 9-7751*



HERCOFLEX® 600—a new and different vinyl plasticizer—is now in full commercial production. An ester derived from Hercules pentaerythritol, Hercoflex 600 offers a superior combination of low temperature and high temperature performance and has excellent electrical properties. This premium plasticizer for vinyl resins is also compatible with nitrocellulose, ethyl cellulose, and Parlon® (chlorinated rubber). You'll find technical data in this new booklet. For your copy, write:

Synthetics Department

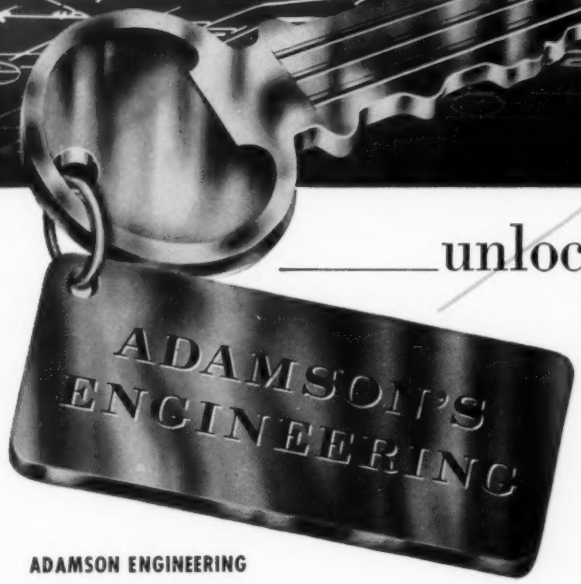
HERCULES POWDER COMPANY

INCORPORATED

916 Market St., Wilmington 99, Del.

SH55-2

_____unlocks the door to progress in many industries



ADAMSON ENGINEERING

Has Contributed to Progress in the Following Fields

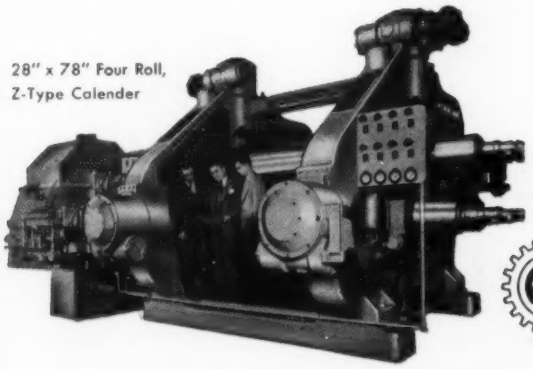
- Rubber
- Plastics
- Plywood
- Hardboard
- Concrete Block
- Chemicals
- Food Processing
- Pharmaceuticals
- Steel
- Automotive
- Aircraft

Machine development, plant layout and industrial control is our business. By creating and perfecting unusual processes and special machinery for making entirely new products, or for processing new materials, Adamson Creative Engineering has enabled many industries to reduce expense and meet competition through the manufacture of better products at lower cost.

Our staff of experienced, highly trained engineers and designers, served by the entire resources of United Engineering and Foundry Company's Research, Development and Metallurgical Departments, is available and competent to find a solution to your processing problems. Their services are also available to assist you in the modernization of conventional or existing equipment.

Adamson United's creative engineering assistance is as near as your telephone.

Why not call us today?



28" x 78" Four Roll, Z-Type Calender

Adamson United Company

AKRON 4, OHIO

SALES OFFICES IN PRINCIPAL CITIES

Subsidiary of United Engineering and Foundry Company

Plants at: PITTSBURGH • VANDERGRIFT • YOUNGSTOWN • CANTON • WILMINGTON (Lobdell United Division)

How Chlorowax® can help you push down vinyl compounding costs

When you are looking for ways to cut costs . . . look at Chlorowax 40 as a secondary plasticizer.

It has a proved record of many cases where it has cut compounding costs by 1.5c to 2.5c per pound volume, without impairing the finished product. In some instances, it has improved quality.

Here are some of the other advantages processors get with Chlorowax compared with other secondary plasticizers:

Low Volatility—Lower than DOP.

No Odor—Important near foods and in closed areas.

Non-Toxic—Eliminates another limiting factor.

Non-Migrating—Reduces lacquer lifting.

Amounts of Chlorowax 40 that can be used as a secondary plasticizer and other helpful data are covered in DIAMOND Chlorowax Bulletin No. 9. Write for your copy, today.

DIAMOND ALKALI COMPANY, Chlorinated Products Division, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS®

Diamond Chemicals

Plants at: PITTSBURGH • VANDERGRIFT • YOUNGSTOWN • CANTON • WILMINGTON (Labdell United Division)

A special report on PROGRESS AT H-P-M

To Our Customers and Friends

1. H-P-M is now pledged to a series of broad, new policy decisions designed to strengthen our sales, service and manufacturing program. The growing demand for hydraulic equipment increases our responsibilities to the industry.
2. H-P-M will carry out this program as an independent company.
3. Significant developments are in the making for the months ahead. They will be announced within the next few months.
4. Key executives have been selected to play important roles in this new program. Their combined experience with H-P-M in the hydraulic field will accelerate the fulfillment of our plans and strengthen our position.

WILLIAM H. BENNETT
Vice President in Charge of Sales
A well-known H-P-M personality and graduate of University of Cincinnati, has served H-P-M as engineer, Sales Engineer, Director of Engineering, Sales Manager and now Vice President in Charge of Sales. Extensive experience in all phases of hydraulic design and application. Professional Engineer.

GLEN R. PITTMAN
Sales Manager, Hydraulic Power Division
Has successfully served in engineering capacities with H-P-M since 1938. Left the company briefly for another position and returns to head up Power Division sales of hydraulic pumps, cylinders, valves and power systems.

J. W. ARNOLD
Vice President in Charge of Manufacturing
A graduate of General Motors Institute with successful manufacturing and engineering experience in companies such as Cadillac, Ford, Clark Equipment Co., United Stove, and Erie Engine and Manufacturing Co. He brings to H-P-M a wealth of manufacturing managerial talent.

WILLIAM N. WOODWARD
Secretary-Treasurer
A graduate of Ohio State, has served the company since 1946 in the accounting department, as controller and assistant secretary. His promotion to Secretary-Treasurer is an important step in H-P-M's new program.

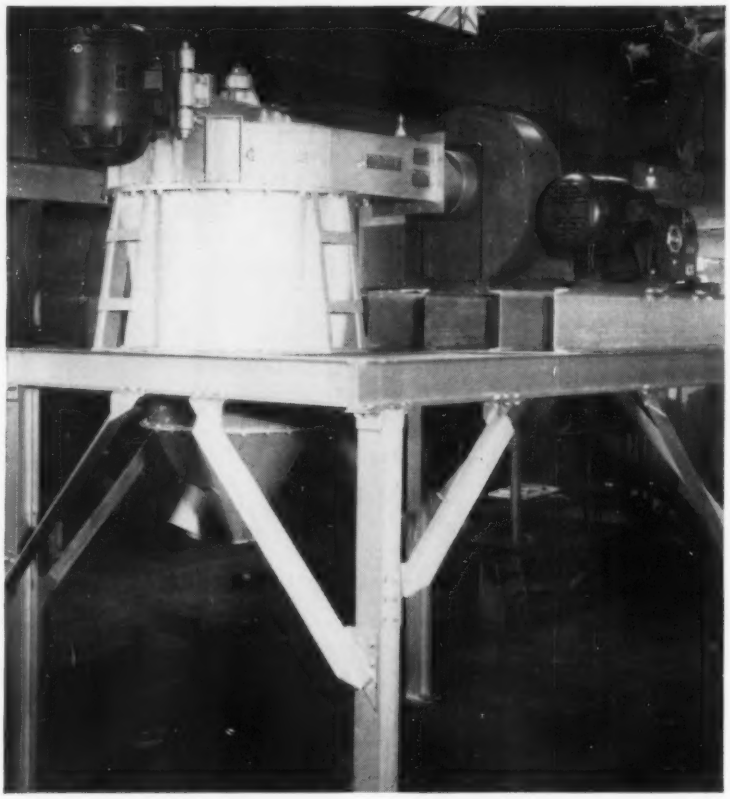
ROBERT J. LINDSEY
Director of Engineering
Another experienced H-P-M engineer promoted up through the ranks from engineer to Director of Engineering. Served as Chief Engineer of Elmes Engineering Division, American Steel Foundries. He returns to H-P-M now as Director of Engineering.

THE HYDRAULIC PRESS MANUFACTURING CO.
1010 Marion Road,
Mount Gilead, Ohio
U. S. A.

HPM

NEW TYPE STURTEVANT AIR SEPARATOR

Recovers Fines in Micron Ranges



Now the famous Sturtevant Whirlwind Air Separator, so widely used throughout industry for fast recovery of fines, has been specially designed to "pick-off" classified materials such as pigments, limestone fillers, plastics, oyster shells, etc., in micron sizes.

These highly efficient air separators select a continuously uniform product of desired fineness. Used in a closed circuit with grinding mills, they increase production, cut power costs.

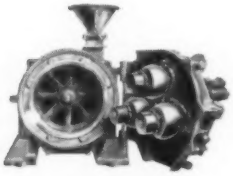
Large feed opening, rugged construction, ease of adjustment, low power consumption assure economy of operation and minimum upkeep. Write for further information.

STURTEVANT
MILL COMPANY
110 CLAYTON STREET
BOSTON 22, MASS.

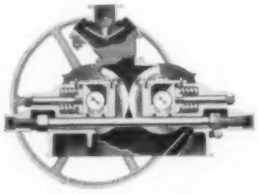
Designers and Manufacturers of:
CRUSHERS • GRINDERS • SEPARATORS
CONVEYORS • MECHANICAL DENS and
EXCAVATORS • ELEVATORS • MIXERS

OTHER STURTEVANT EQUIPMENT

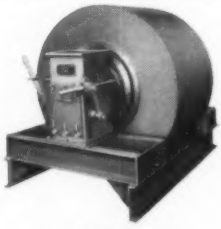
MICRONIZER® GRINDING MACHINE
A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired.
Sturtevant Micronizer grinding machines are available in many sizes and capacities.



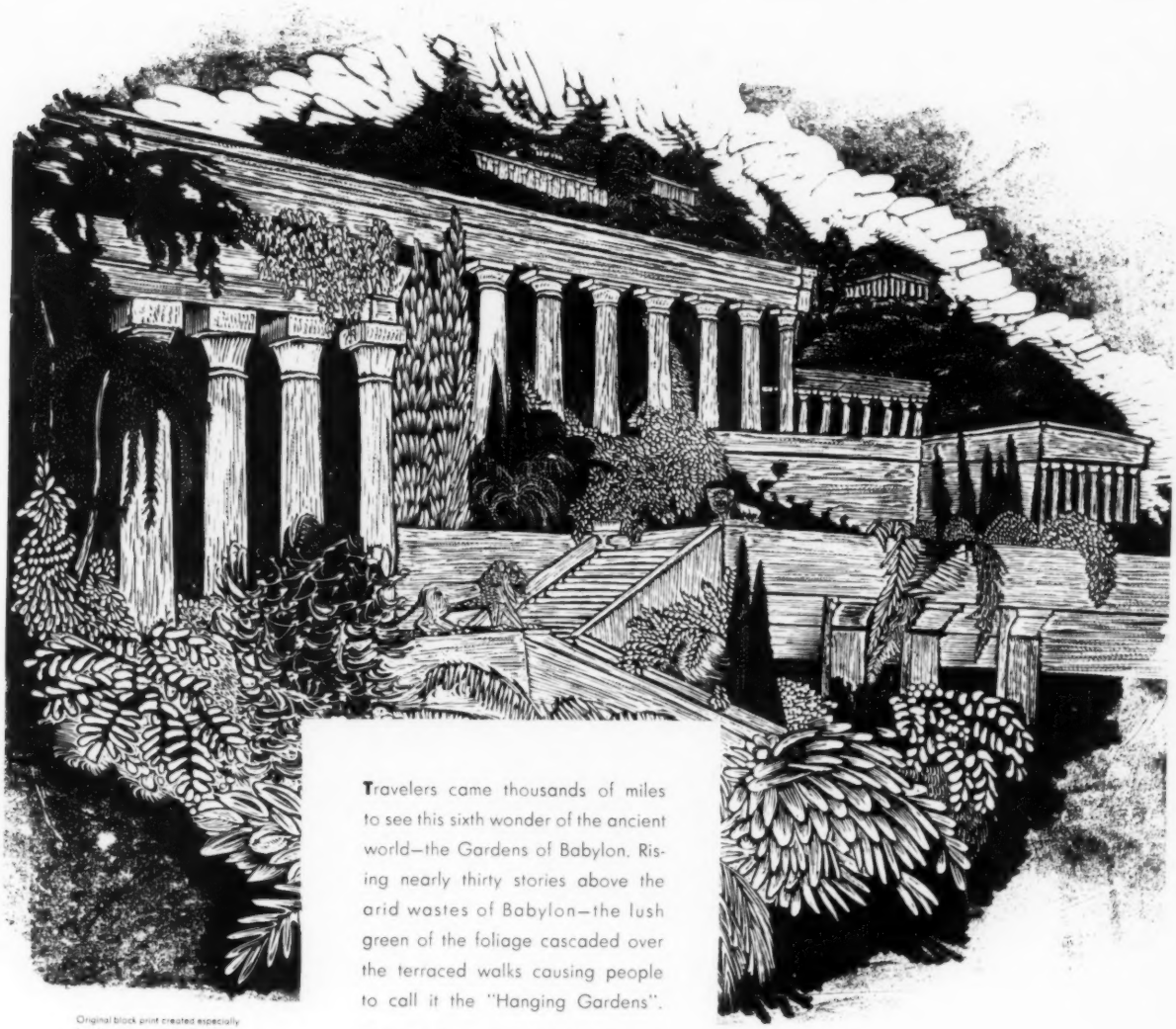
RING-ROLL MILLS
For medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operate in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS
For granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



BLENDER
Four-way mixing action assures a thoroughly blended product. Open-door accessibility permits easy cleaning. Available in many mixing capacities for ¼-ton per hour and up.



Original block print created especially for this series by artist Zeke Ziner.

Travelers came thousands of miles to see this sixth wonder of the ancient world—the Gardens of Babylon. Rising nearly thirty stories above the arid wastes of Babylon—the lush green of the foliage cascaded over the terraced walks causing people to call it the "Hanging Gardens".

The Gardens were built by Nebuchadnezzar for his lovely young wife who longed for the green hills of her native Media. To supply adequate moisture, an intricate system of pumps and drains was designed to lift water from the nearby Euphrates. The Gardens were a triumph of imagination and engineering—a magnificent example of ancient ingenuity.

An example of modern ingenuity is the list of plastics problems solved by Plenco engineers. Perhaps you have a plastics problem that has you "hanging" . . . why not call Plenco and talk it over—or write to:

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

"You mean live fish?"

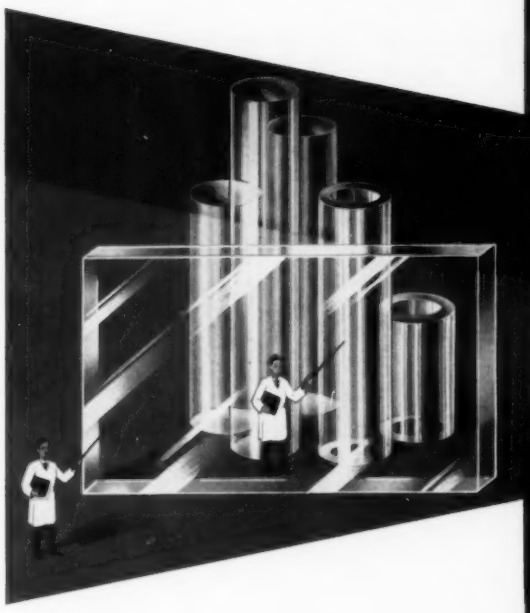
Exactly: Live fish. In water.
In a corrugated box.

A customer of ours uses this unique bag-in-a-box-in-a-box to ship live tropical fish all over the world. Says it's the most damage-proof and economical package he's used in 32 years as an aquariist.

Just goes to show you:
Nothing's impossible for H&D Package Engineers. Why not let 'em tackle your packaging problem?

HINDE & DAUCH

AUTHORITY ON PACKAGING • SANDUSKY, OHIO
13 FACTORIES • 40 SALES OFFICES



Celanese
ACETATE
- SHEETS
- FILM

Rohm & Haas
PLEXIGLAS
- SHEETS
- RODS
- TUBES

DuPont
LUCITE
- RODS
- TUBES

DuPont
NYLON
- RODS
- STRIPS
- TUBING
- SLABS
- DISCS

DuPont
TEFLON
- TAPE
- RODS
- TUBES
- SLABS

Bakelite
VINYLITE
- RIGID
- SHEETS

DuPont
POLYETHYLENE
- FILM
- SHEETS
- RODS
- TUBES

POLYSTYRENE
- SHEETS
- RODS
- TUBES
- SLUGS

FIBERGLAS
- MATS
- CLOTH

Phenolic
LAMINATES
- SHEETS
- RODS
- TUBES

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NEW R/M ASBESTOS FELT PROVIDES HIGH IMPACT AND BURST STRENGTH

R/M Style 9524 is a carded blend of long crude and long spinning ferrous-type fibers, combined with an open weave glass cloth. It was designed for applications where toughness, durability, or improved resistance to resin crazing is desired. With its use, high burst and leak pressures can be obtained in tubular structures, and resistance to weepage in such items as water and fuel tanks, pipes, etc. The impact strength of R/M Style 9524 is superior, and its wet strength abnormally good, sufficient for easy handling under the most adverse conditions.

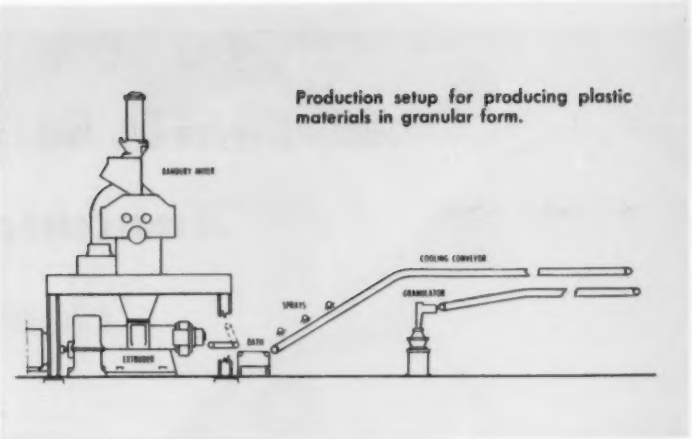
Write on your company letterhead for free copy of this brochure, containing technical and design data on R/M's unique line of Asbestos Cloths, Pyrotex Felts, and Novabestos® Papers.

RAYBESTOS-MANHATTAN, INC.
ASBESTOS TEXTILE DIVISION, Manheim, Pa.

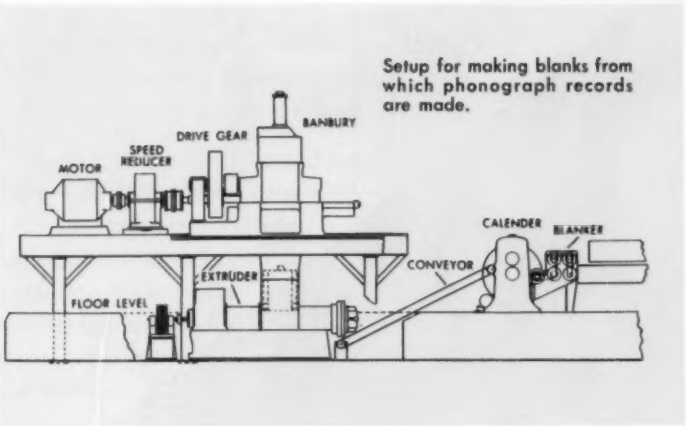
FACTORIES: Manheim, Pa. • Bridgeport, Conn. • No. Charleston, S.C. • Passaic, N.J. • Neenah, Wis. • Crawfordsville, Ind. • Peterborough, Ont., Canada

RAYBESTOS-MANHATTAN, INC., Asbestos Textiles • Abrasive and Diamond Wheels • Packings • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Rubber Covered Equipment • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Bowling Balls

F-B MATCHED PRODUCTION UNITS

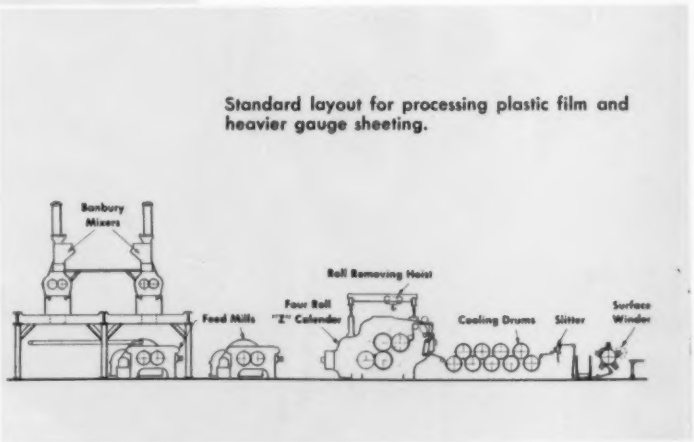


Production setup for producing plastic materials in granular form.



Setup for making blanks from which phonograph records are made.

EFFICIENCY UP- COSTS DOWN



Standard layout for processing plastic film and heavier gauge sheeting.

As much of the processing equipment manufactured by Farrel-Birmingham normally operates in sequence, the company maintains an Engineering Planning Division, for the development of complete production layouts.

The processing setups diagrammed above are typical of the work performed by this division. Each layout is composed of production machines matched in capacity to prevent "choking" or "starving" of succeeding units. Production flows without costly interruption. Manual aid and supervision are cut to a minimum.

Farrel-Birmingham designs these layouts to meet widely varying physical and economic requirements. Our engineers will work with your engineers to help you select the right system for your needs.

Send for details of processing setups, and ask for information about any of the production units listed below.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Pittsburgh, Chicago, Fayetteville (N.C.), Los Angeles, Houston

Farrel-Birmingham®

F-B PRODUCTION UNITS

Banbury Mixers, roll mills, calenders, extruders, plasticators, hydraulic presses and other equipment.

FB-1021

Giant fans expel 300,000 cu. ft. of air per minute from working areas through nylon fabric tubes.

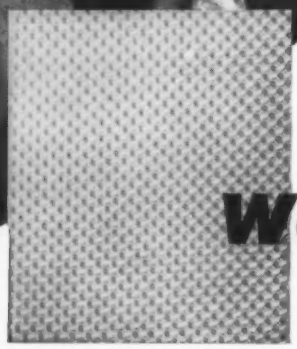
Fabric helps Anaconda clear the air— one mile down!

In Anaconda's Butte mine workings—a mile below the earth's surface—temperatures sometimes rise above 100° F. Humidity may be 98%. Dust thickens and clings.

Coated fabric tubes are Anaconda's answer to the ventilation problem, resulting in greater mine safety, more comfortable working conditions. Made of Wellington Sears filament nylon fabric coated with neoprene, these tubes carry dust-laden air to proper exhaust exits.

Their fabric must be flexible—it twists through corridors. It must be strong to withstand abrasion. It must be light (14 oz. a sq. yd.) for easy movement. It must resist the disintegrating forces of heat, humidity, dust, mildew and acids. Wellington Sears is proud that its DuPont nylon fabrics will be installed in all Butte mine workings.

This fabric is only one of many types and constructions offered by Wellington Sears for coating and impregnation. Whether your need is the right fabric for neoprene, vinyl or rubber coating—you'll find your answer at Wellington Sears.



Wellington Sears

A Subsidiary of West Point Manufacturing Company

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For Coated Materials, High and Low Pressure Laminates And Other Reinforced Plastic Products

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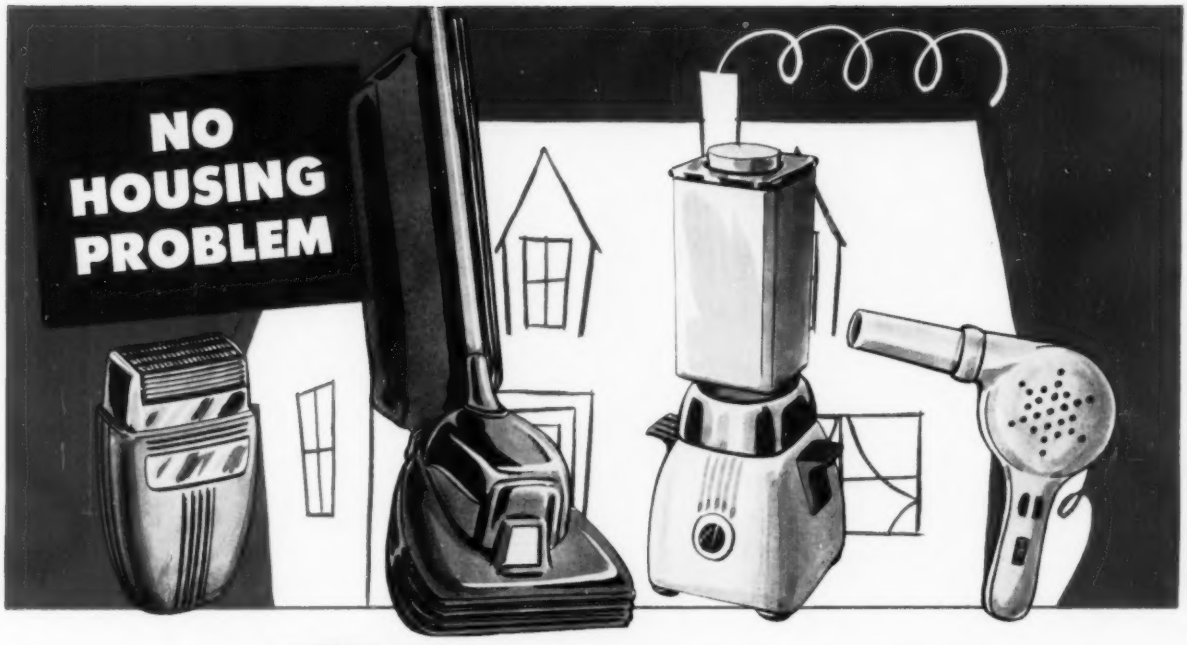


for appliances made with CYCOLAC®

THE *New* HIGH-IMPACT THERMOPLASTIC RESIN

CYCOLAC is a single uniform resin which is permanently thermoplastic, permitting fast molding, calendering and extruding, and re-use of trim and cutting scrap. Also economical to form from press-polished sheets by vacuum, air-pressure, or mechanical methods over inexpensive molds of wood, plaster, aluminum, etc.

CYCOLAC is free from nerve or shrinkage; with a high in impact-resistance and heat-distortion temperature, plus a low brittle point. Resistant to many oils, solvents and corrosive chemicals. Very light — Sp. Gr. 1.01.

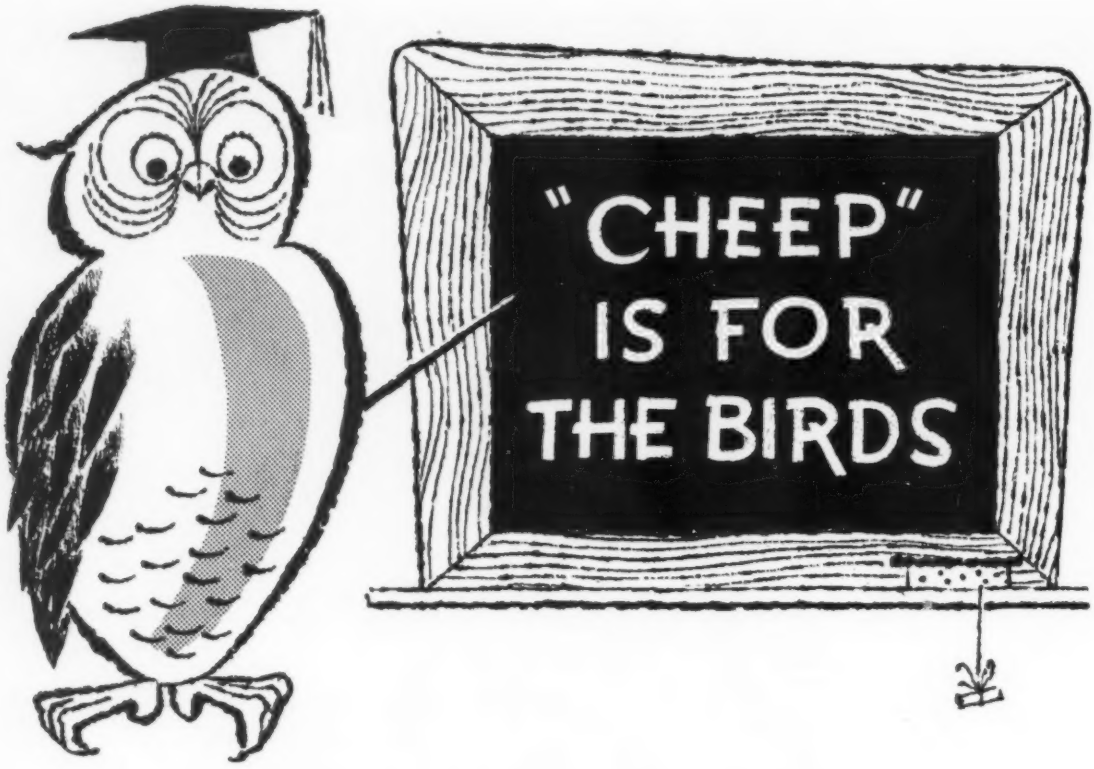
THE PERFECT RESIN FOR THE MANUFACTURE OF HOUSINGS FOR MOST ELECTRICAL APPLIANCES

- BRIGHT GLOSSY COLORS
- TOUGH
- LIGHTWEIGHT
- NON-WARPING
- NON-CRACKING
- RIGID

GET THE FACTS — *Write* TODAY FOR TECHNICAL LITERATURE

MARBON CHEMICAL
Division of BORG-WARNER
GARY, INDIANA

MARBON CHEMICAL . . . *Precision Resins for Precision Made Products*



The wise old owl is likely to tell you that it's more expensive to buy "cheap." The guy who is out for price alone winds up with exactly what he bargained for . . . a low grade, poor quality product. If that's what he wants . . . O. K.! But that same wise old owl will tell anyone who demands fine craftsmanship and intelligent, reliable service that a custom molder of long, successful experience is his best bet. Boonton, with more than thirty years and with a history of literally thousands of successful jobs to our credit, stands ready to offer its vast facilities—the latest machines and skilled technicians—to mold your product . . . the way you'd like it done.

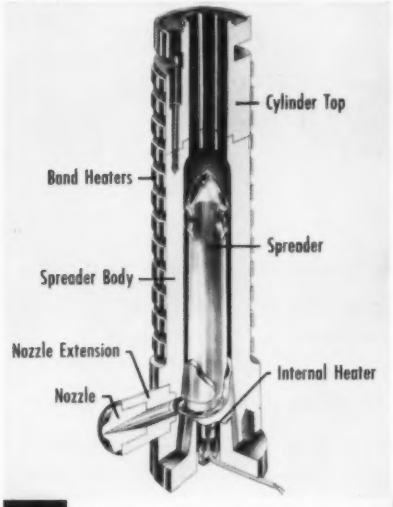
BOONTON MOLDING CO.

BOONTON, NEW JERSEY

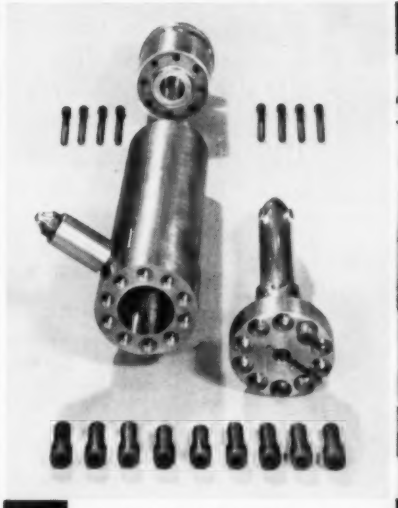
NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

LESTER Internally Heated CYLINDERS

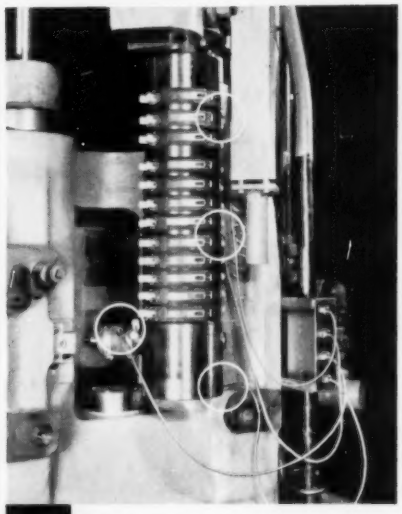
Can anyone match these advantages!



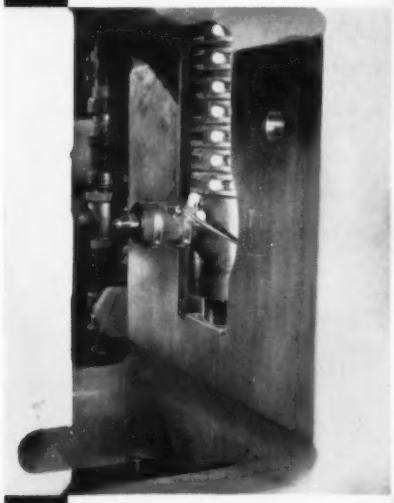
1 Nearly double the active heat contact area—proven by 10 years of record-breaking use.



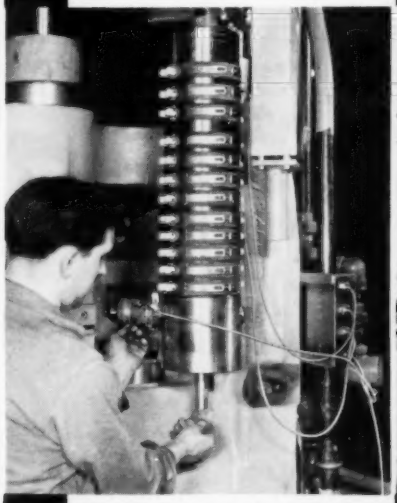
2 Mechanically indestructible, no weak ribs, slots or welds, chrome plated throughout. Water-cooled plunger.



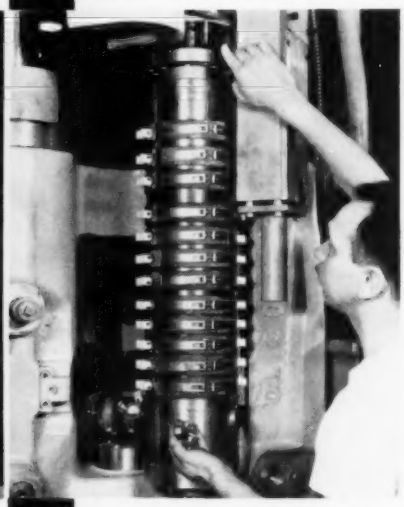
3 Four pyrometer zones—incomparably versatile with uniform heat distribution. Material feeds into full bore.



4 Frame supports cylinder and takes plunger force. Thermal expansion cannot crush the nozzle.



5 You can reach all heaters for checking or replacement without removing the cylinder.



6 You can remove a cylinder in 10 minutes—or clean it on the machine within 2½ hours.

The Internally Heated Cylinder is standard equipment on all Lester 4, 8, 12, 20 and 48 ounce machines. Write for complete specifications.

LESTER INJECTION MOLDING MACHINES

REPRESENTATIVES

New York . . . . Steven F. Krould
Detroit . . . . . M. R. Tenenbaum
Chicago . . . . . J. J. Schmidt
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Coral Gables . Morton Machinery Sales
Cincinnati . . . Index Machinery Corp.
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Basle, Switzerland . . . . Hermann Walti

distributed by LESTER-PHOENIX, INC., 2621-Q CHURCH AVENUE • CLEVELAND 13, OHIO

PAY LESS FOR MORE RUGGED

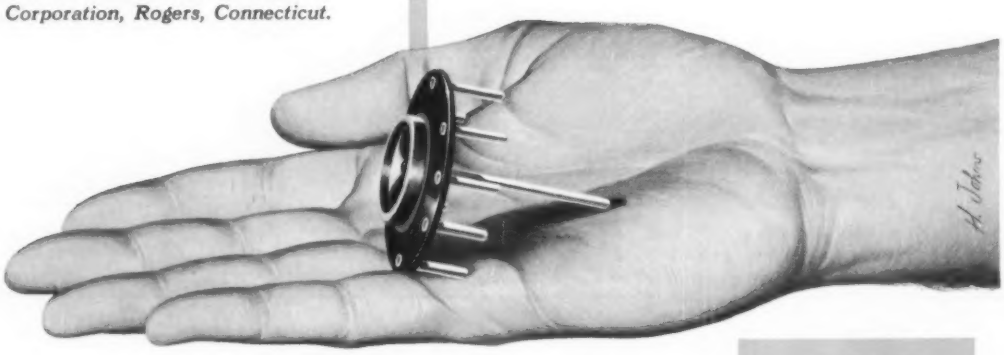
PLASTICS WITH MOLDED-IN METAL COMPONENTS

USE ROGERS PHENOLIC SHEET MOLDING MATERIALS

Three series of Rogers phenolic *sheet* molding materials are available: RM 9275, a cellulose-filled grade with an impact strength of 1.8; RM 4000 grades, glass-cellulose reinforced, with impact strengths ranging from 4.0 to 7.0; and RM 2035, an electrical grade, designed when properly molded to meet electrical standards equivalent to NEMA XXXP laminate. *Please write for data sheets to Dept. P, Rogers Corporation, Rogers, Connecticut.*

MAKE THIS COMPARISON AND SEE WHY

ROGERS PHENOLIC SHEET MOLDING MATERIALS	CONVENTIONAL HIGH IMPACT PHENOLICS
Low bulk factor of 1½ to 1	High bulk factor of 10 or 12 to 1
Low cost shallow molds	Expensive deep molds
Preforms can be blanked and pre-drilled for accurate location with inserts	Volumetric loading or hand preforming makes for difficulty in locating material with inserts
Preforms blanked from sheets of uniform thickness form mold charges of exact weight	Mold charges difficult to measure — require exact weighing to avoid over- or under-charging
Fast, uniform preheating	Slower, less uniform preheating
Good to excellent moldability	Poor to fair moldability
Low tooling cost, simplified production molding, minimum rejects, low unit parts cost	High tooling cost, tricky, expensive molding operations, high reject rate, high unit parts cost



ROGERS CORPORATION

ROGERS, CONNECTICUT

PRODUCTS

DUROIDS—for Gaskets, Filters, Electronic Devices, etc.
SHOE MATERIALS—for Counters, Midsoles, Liners, etc.
ELECTRICAL INSULATION—for Motors, Transformers, Generators, etc.
PLASTICS—Special Purpose Molding Compounds and Laminates.

SERVICES

FABRICATING—Including Combining, Coating, and Embossing.
DEVELOPMENT—Research and Engineering of New Materials, Parts, and Products.

MANUFACTURERS and FABRICATORS of Acrylics, Ureas, Fabric and Paper Base Phenolics, Polystyrenes, P.V.C., Fibres, Butyrates, Printed Circuitry and High Pressure Laminates USE and RECOMMEND...

Radialloy-Tipped*

Circular Saw Blades

Fine chip-free cuts • Close tolerances
Long blade life • Smooth edges • Economy

These skillfully designed, durably constructed Radialloy-Tipped Circular Saw Blades provide optimum production efficiency. They actually *boost* production profits higher—they operate *faster, smoother* and they are available for *close tolerance* work to suit your application problem, thus eliminating costly and wasteful trial and error methods.

This Saw Blade Is Really Different, Far Superior! Super-Finishing is the reason why these blades provide *higher performance* and *operating economy*. They do not vibrate when used on typical "tough sawing" materials such as plastics and plastic laminates. Why? *There's no variation in tooth construction!* They're engineered from the heat-treated shank out as carbide blades—*they are not* regular saws with carbide tips added!

And we are ready to prove their superiority! We'll gladly furnish sample cuts of your materials to illustrate the smooth edged, chip-free, close tolerance cut obtained with these saws

WRITE for prices and brochure on our complete line.

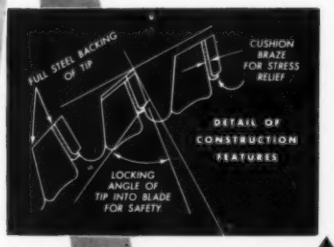
Radialloy-tipped SUPER FINISHED SAWS & CUTTERS

RADIAL CUTTER MANUFACTURING CORPORATION

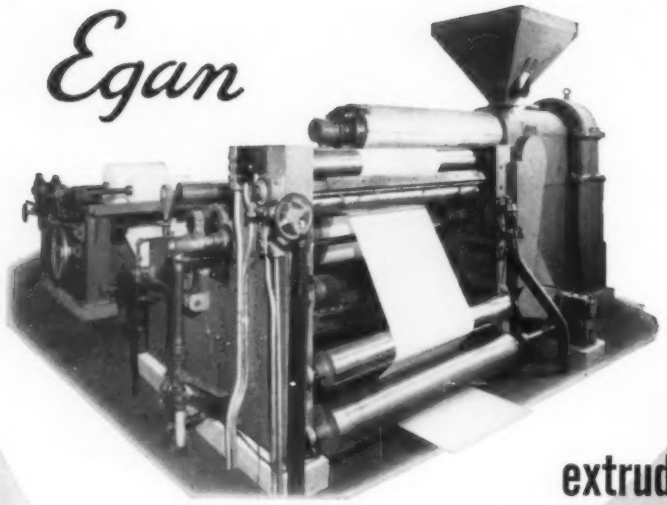
829 Bond Street, Elizabeth 4, New Jersey

SPECIALISTS AND LEADING MANUFACTURER OF CARBIDE-TIPPED SAW BLADES

* Reg. U. S. Pat. Off.


FULL STEEL BACKING OF TIP
CUSHION BRAZE FOR STRESS RELIEF
DETAIL OF CONSTRUCTION FEATURES
LOCKING ANGLE OF TIP INTO BLADE FOR SAFETY

Egan



polyethylene extruder-laminator

(Above pictured installation at the Milford, N. J. plant of RIEGEL PAPER CORPORATION)

COMPLETE PACKAGED MACHINE

Combining in one unit, in engineered balance, two famous units—The Egan Extruder and the Egan Laminator. Planned for your current—or expanding—production, available in varying sizes—from 24″ Pilot Plant Size to 96″, 1000 feet per minute continuous operation. Machines are capable of coating on paper and paperboard, cellophane, foil, glassine and cloth.

35

30 **Egan machines now in operation.**

9

5 **Egan machines under construction.**

Approximately 75% of all polyethylene laminating machines now in operation anywhere in the world are Egan Equipment.

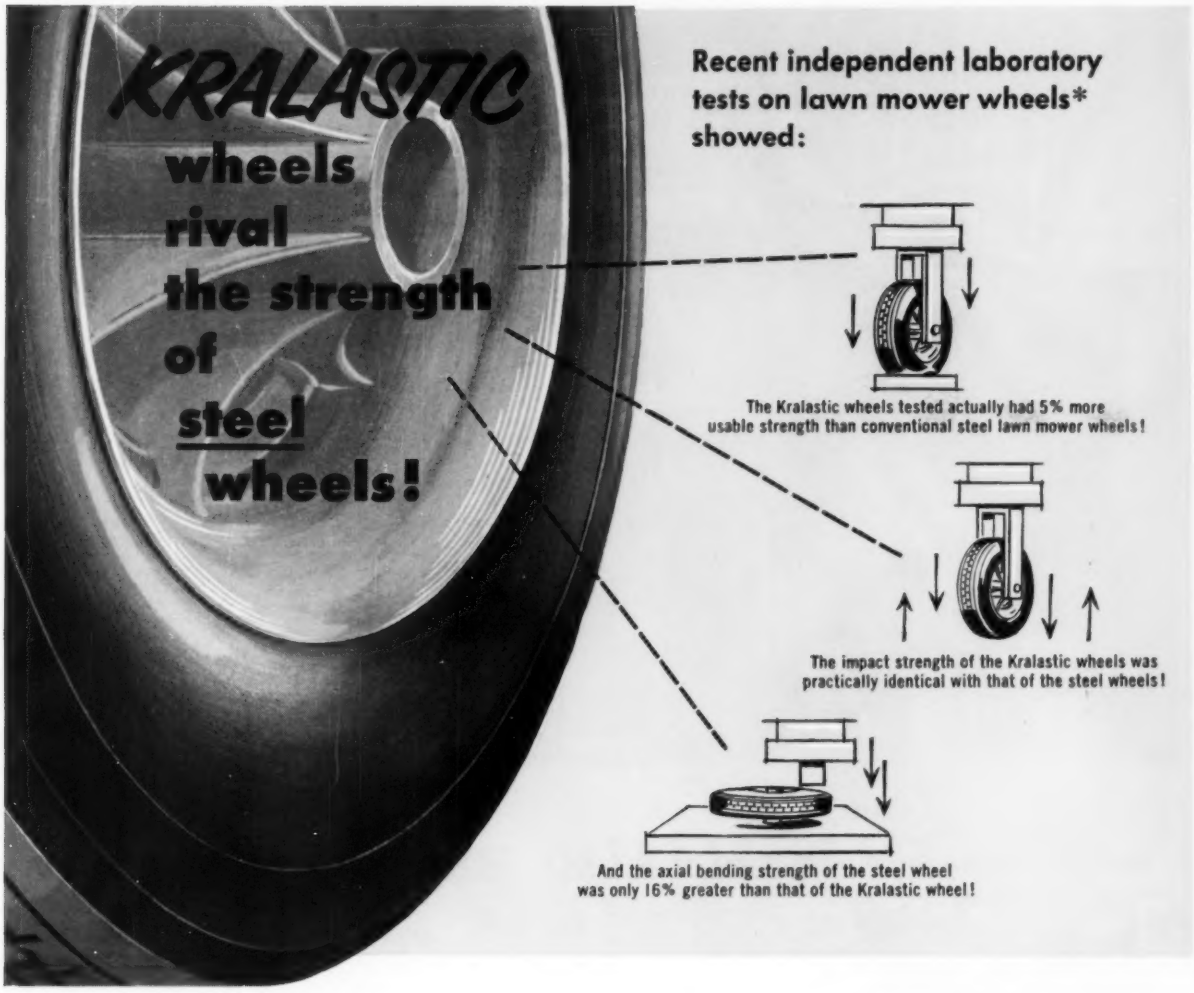
FRANK W. EGAN & COMPANY, Somerville, New Jersey

Designers and Builders of Machinery for the Paper Converting and Plastics Industries

Cable Address: EGANCO—SOMERVILLE (NJER)

Representatives: WEST COAST — John V. Roslund, 244 Pacific Bldg., Portland, Ore. MEXICO, D. F. — M. H. Gottfried, Avenida 16 De Septiembre, No. 10.

Licensees. GREAT BRITAIN — Bone Bros. Ltd., Wembley, Middlesex. FRANCE — Achard-Picard, Remy & Cie, 36 Rue d'Enghien Xe, Paris. ITALY — Emanuel & Ing. Leo Campagnano, Via Borromei 1 B/7, Milano. GERMANY — ER-WE-PA, Erkrath, bei Dusseldorf.


KRALASTIC
wheels
rival
the strength
of
steel
wheels!
Recent independent laboratory tests on lawn mower wheels* showed:
The Kralastic wheels tested actually had 5% more usable strength than conventional steel lawn mower wheels!
The impact strength of the Kralastic wheels was practically identical with that of the steel wheels!
And the axial bending strength of the steel wheel was only 16% greater than that of the Kralastic wheel!

These tests—made by an independent laboratory for Michigan Molded Plastics Co.—demonstrate clearly the amazing strength Kralastic wheels offer.

Even more important, though, are the many other advantages Kralastic gives wheels. An unusual rubber-resin blend with a unique combination of hardness *and* toughness, high dimensional stability, and reliable performance over a wide temperature range, Kralastic produces wheels that are...

- self-lubricating and practically wear-proof
- rust-proof—corrosion proof
- attractively, permanently colored
- less than half the weight of aluminum
- highly resistant to abrasion
- easily assembled—require no bearings
- *relatively inexpensive!*

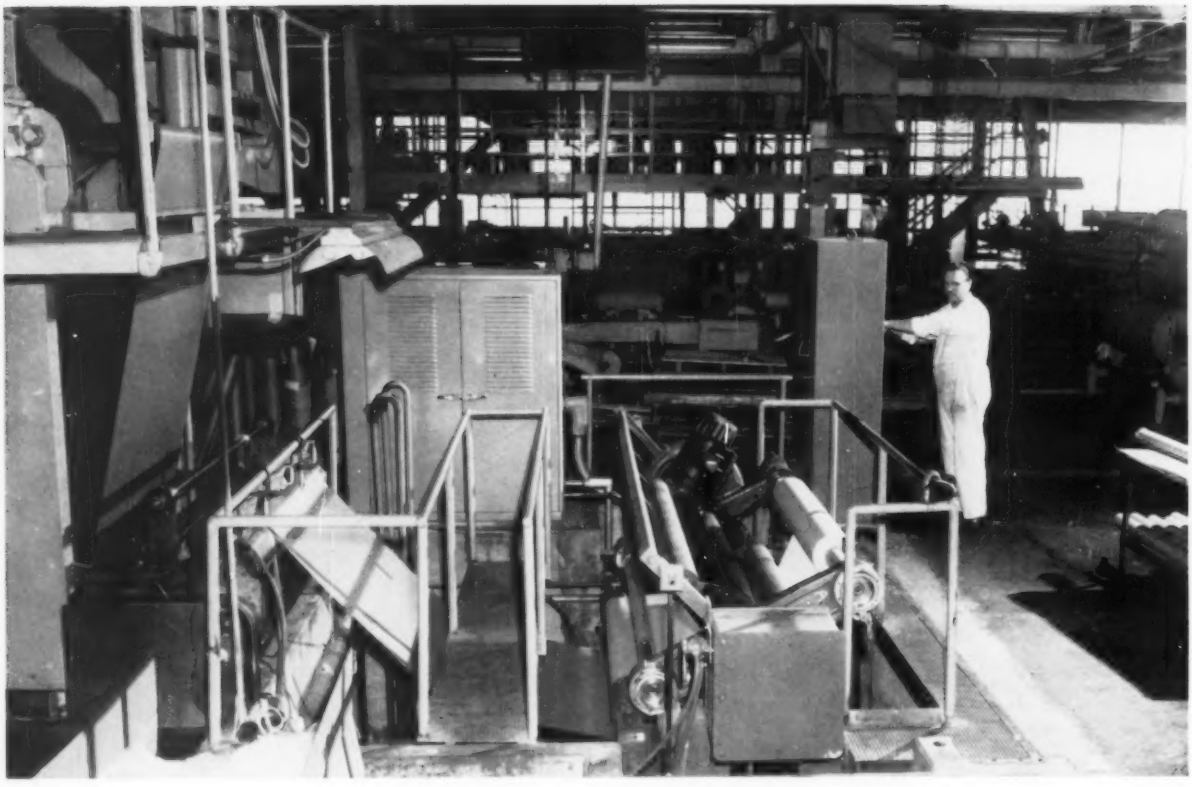
Why not consider the many opportunities for improved product performance and *increased sales* Kralastic® offers you? *And feature these advantages.* They will help you sell the complete product. For further information, write us on your company letterhead *today.*

*Kralastic wheels, manufactured by Michigan Molded Plastics Co., Dexter, Mich.

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York • Philadelphia • IN CANADA: Naugatuck Chemicals, Elmira, Ontario
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N. Y.

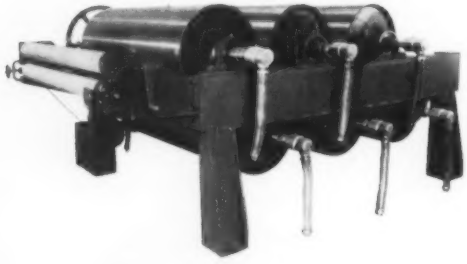


PLASTIC TAKE-OFFS AND WINDERS

Ferristart surface winder for film and sheeting with manual continuous starts on new cores.

This is a Dilts Model 40 2-arm rotating type winder in line with a calender train on production of vinyl film and sheeting. A special dancer roll allows for absolute minimum tension to be held constant over the complete winding cycle. Automatic starts are made without foldbacks or wrinkling. Color movies of this winder in action are available for showing.

Dilts



Cooling train for plastic film and sheeting. Double Wall Construction.

Dilts manufactures complete plastic take-off equipment from calender or extruder to continuous surface or center winders for film and sheeting over a wide range of gages, speeds, tensions, widths and roll diameters.

Write for full information.

THE BLACK-CLAWSON COMPANY
DILTS MACHINE WORKS DIVISION
FULTON, NEW YORK

GLIDPOL*...

ideal polyester resin for deep, small-diameter preforms!

Made of GLIDPOL reinforced plastic, these 225-gallon droppable fuel tanks are produced for the U. S. Air Force by the Molded Products Division of Admiral Corporation. They offer high strength with low weight . . . superior resistance to chemicals, corrosion, weathering, acids, oils, other liquids . . . and, unlike metal tanks, can't be salvaged as scrap by the enemy.

Using GLIDPOL, Admiral accurately mass-produces the small-diameter preforms—nose, tail and three center sections—comprising the finished tank. Dimensional accuracy is very important as capacity is varied by adding or removing sections which must be interchangeable.

You, too, may have a reinforced plastic application that can be solved by one of the versatile family of GLIDPOL polyester resins, which can be cast, molded, potted or laminated. Glidden Technical Service can recommend the particular GLIDPOL that will meet your requirements for corrosion and weather resistance, high structural and impact strength, dielectric and wet strength. Complete information is available upon request.

THE GLIDDEN COMPANY
Industrial Finishes Division
11005 Madison Avenue, Cleveland 2, Ohio

San Francisco • Los Angeles • Chicago (Nubian Division—1855 N. Leclaire Ave.)
Minneapolis • St. Louis • New Orleans • Cleveland • Atlanta • Reading
Canada: Toronto and Montreal

*A Glidden Trade-Mark

For complete, detailed specification data on GLIDPOL resins, write (on your company letterhead) for Technical Bulletin MP-855.

GLIDPOL
POLYESTER RESINS

QUALITY Glidden PRODUCTS

DAKE PRESSES

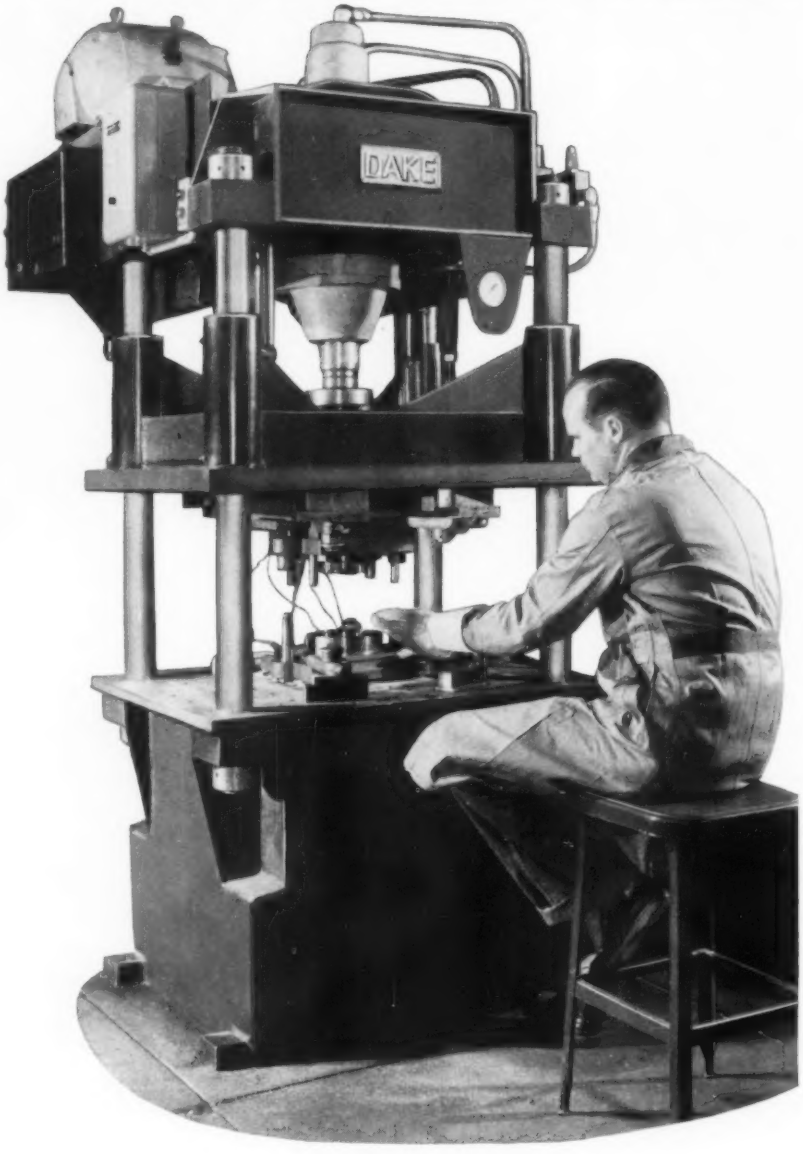
for compression molding reinforced plastics

Dake Plastics Presses are engineered by men experienced in the plastics industry who can help you meet special needs and requirements, as well as provide better equipment for ordinary molding.

Standard models are electric-hydraulic in operation, with capacities ranging from 25 to 300 tons. They are adjustable for stroke, pressure, temperature, and timing of the cure.

The operation is started by pressing dual palm switches (for safety), and is automatic through the entire curing cycle and return of the platen to starting position.

Other presses with simpler controls and less automatic operation are also available. Send for Bulletin #273, and tell us your special requirements.



Dake Corporation, 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES

Arbor Presses

Hand-Operated Hydraulic

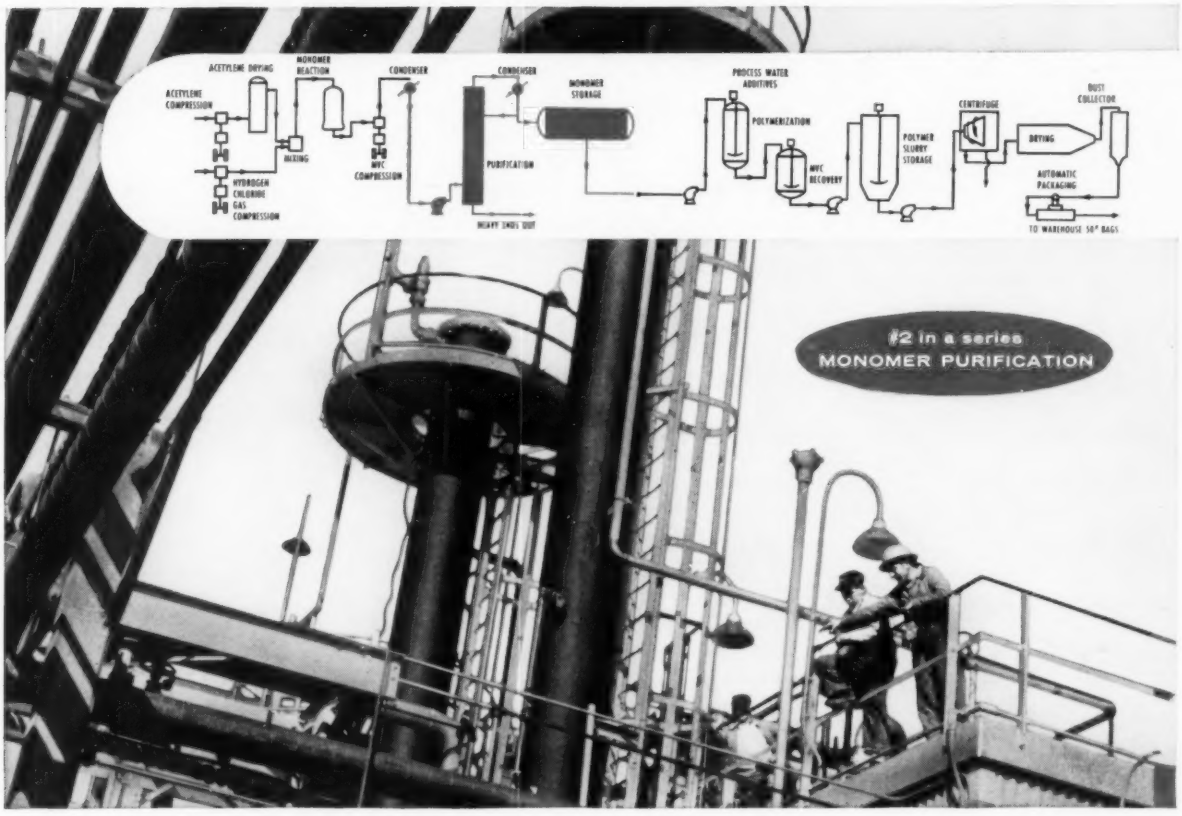
Power-Operated Hydraulic

Guided Platen

Gap Type Presses

Movable Frame

Another Quality Chemical by General Tire



How quality is built into Vygen*

General Tire's PVC, Vygen, is a high quality resin produced with the aid of modern electronic instrumentation. The synthesis gases, hydrogen chloride and acetylene, and the resulting monomer are analyzed and metered continuously to a high degree of accuracy to assure ultimate product quality.

Operators exercise precise control of process conditions in the monomer control center illustrated above. This meticulous care in the first stage of Vygen production characterizes the entire process and is your assurance of consistent product quality.

For samples and literature write to The General Tire & Rubber Company, Chemical Division, Akron, Ohio.

Chemical Division
GENERAL
THE GENERAL TIRE & RUBBER CO.
VYGEN

Creating Progress Through Chemistry

*T. M. G. T. & R. Co.

General Tire also produces...
Gen-Flo* (Paint Latex) • Gen-Tac* (Vinyl Pyridine Latex) • Kure-Blend MT® (Accelerator Masterbatch) • Glykon* (Polyester Resin) • Polystop® (GRS Shortstop) • Ko-Blend® (Insoluble Sulfur Masterbatch)

L·O·F Glass Fibers Company unites two strong manufacturers ...benefits customers 4 ways

On March 1, two progressive producers of quality glass fiber products united their five plants, their extensive research facilities and their sales-service forces.

The merger—of first-rate importance to every company using glass fiber products—brings into one strong progress-minded organization:

—the combined **Fiber·Glass** and **Corrulux Divisions** of the Libbey·Owens·Ford Glass Company, and...

—**Glass Fibers Inc.** They now become...

—**L:O·F Glass Fibers Company.**

To all users of glass fiber products, this alert and co-operative new organization assures these immediate benefits:

1. *Unsurpassed quality in glass fibers*: Longer, finer, more uniform glass fibers result from the company's exclusive "Electronic-Extrusion" process. These longer, finer fibers assure more efficient insulation; more uniform yarns; stronger reinforcement.
2. *A widely diversified line* of improved glass fiber products: Thermal and acoustical insulation; textile yarns; underground pipe wraps; Q-felt high-temperature insulation; plastic reinforcement and translucent building panels.
3. *Five plants, strategically located* for dependable delivery to meet inventory and production demands of all users.
4. *National coverage* by a force of carefully selected distributors assures conscientious service in all local areas. These independent businessmen can handle your requirements for glass fiber products; advise you on applications.

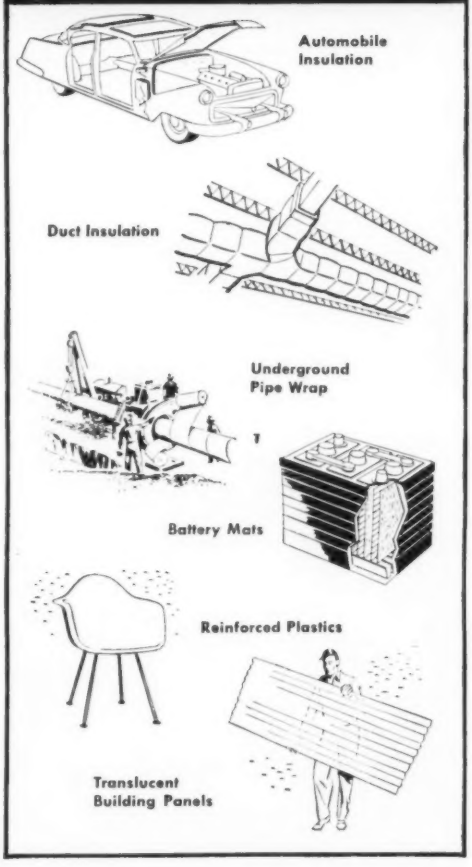
For additional information, contact your nearest L·O·F Glass Fibers office, or write: L·O·F Glass Fibers Company, Dept. 15-85, 1810 Madison Avenue, Toledo 1, Ohio.

L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY
TOLEDO 1, OHIO

Makers of longer, finer glass fibers by the exclusive "Electronic-Extrusion" process.

TYPICAL BASIC APPLICATIONS OF L·O·F GLASS FIBERS' PRODUCTS



L·O·F GLASS FIBERS' PRODUCTS INCLUDE:

Super-Fine and Microlite Thermal and Acoustical Insulation • Microlite Acoustical Baffles • Microlite Hull Board • L·O·F Glass Fibers' and Vitron Textile Yarns • L·O·F Garanized and Chrome Roving, Even-Tension Roving, Chopped Strand • Quartz Micro-Fibers • Microflex and Super-Fine High-Density Compressed Board • Industrial Mat • Blue Flag Underground Pipe Wrap, Duramat Pipeline Outer Wrap, Duramesh Pipeline Fabric, Duratape Pipe and Joint Wrap • Corrulux Translucent Structural Panels

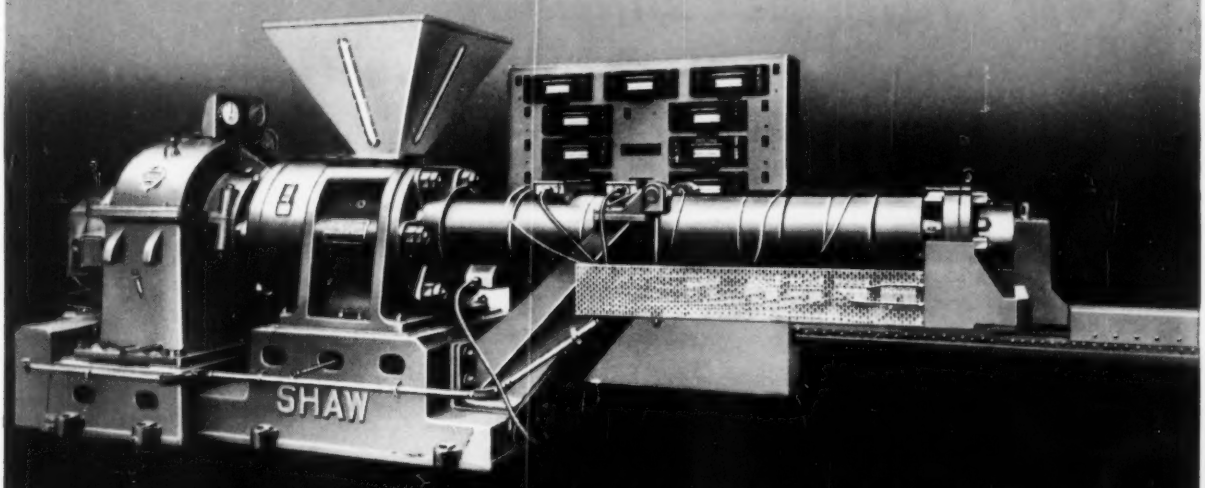
SHAW

8 inch plastic extruder

the BIG machine the world has waited for

- ★ VARIABLE SPEED DRIVE
- ★ DIRECT DRIVE FROM MOTOR TO REDUCTION GEAR UNIT
- ★ SCREW SPEED INDICATOR
- ★ 8" DIA SCREW—VARIOUS DESIGNS FOR SPECIAL PURPOSES
- ★ ALL ELECTRIC HEATING
- ★ SEPARATELY CONTROLLED HEATING ZONES
- ★ HOPPER TEMPERATURE INDICATION
- ★ WATER COOLING OF SCREW AND FEEDBOX
- ★ DIE-HEAD FOR SHEETING (AS ILLUSTRATED) OTHER TYPES OF DIE-HEADS AVAILABLE

Once again, Shaw, the leaders in plastics machinery, introduce a machine of outstanding importance. Among the special features are:—Variable speed drive through reduction gear unit designed to eliminate noise and vibration; screw with metering section at delivery end, designed for efficient water cooling and removable from die end of barrel; central hopper arranged for water cooling; cylinder of hardened alloy steel with temperature range 0-400°C; four separate heating zones with die-head and die-tip heaters separately controlled; speed range 8-80 r.p.m.

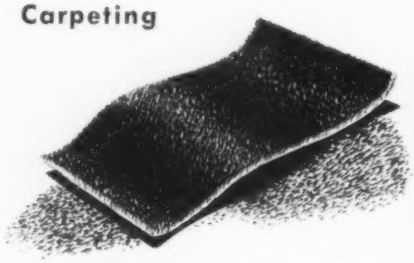


FRANCIS SHAW & CO LTD MANCHESTER 11 ENGLAND

TELEPHONE: EAST 1415-8 (4 LINES) *TELEGRAMS:* CALENDER MANCHESTER 11

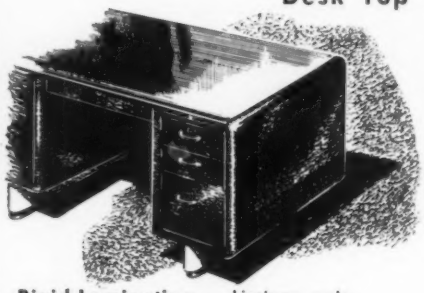
FRANCIS SHAW (CANADA) LTD BURLINGTON ONTARIO CANADA

Carpeting



Flocking — Natural or synthetic fibres, ¼ to 1 mm. long, cemented to fabric, paper, rubber, plastics, metals, wood, etc. to produce the effect of pile, suede, velvet or plush.

Desk Top



Rigid Laminating — Linoleum, melamine-type or vinyl plastic top-sheeting permanently bonded to steel and wooden desks.

TV Casing

Permanent Bonding — High fashion element introduced to TV units through the laminating of colorful vinyl to metal casing.

Tarpaulin

Bonding and Sealing — Canvas tarp sections positioned for stitching with the aid of cement. Later, stitched area is treated with sealer for waterproofing.

One Thing in Common . . .
Angier Adhesives

FOR EVERY INDUSTRY
Latest Developments in Adhesives for Honeycomb Construction and Mylar Film Bonding

ANGIER PRODUCTS INC.

Rubber, Latex and Resin Cements
Pressure Sensitive Cements
Laminants and Sealants
Tie Coats
Resin Emulsions

Here you see just a hint of the countless ways Angier Adhesives contribute to the manufacture of U.S. and foreign goods.

Industry has learned to count on Angier for new economy and effectiveness in joining and fastening *all kinds* of materials.

How do adhesives fit into your picture? The answer might prove to be a very profitable surprise. You will never know until you talk to an Angier Products man. May we make an appointment?

Call or write Dept. A at the nearest Angier Plant for personal attention. We will help you define your problem as well as solve it. Inquiring will not obligate you in any way.

Angier Products

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Midwestern Plant: Huntington, Indiana

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MUEHLSTEIN

REPROCESSED PLASTICS

Don't let the profit slip away. If you use Muehlstein Polystyrene, Polyethylene, Vinyl and other Thermoplastic materials, you're guaranteed important savings in material cost. You rake in more profits! Special problem? Our new laboratory assures you top quality control, efficient color matches—complete satisfaction. Call on us today and save.

NOTE: We offer top prices for distressed inventories of molded parts, purgings and all thermoplastic materials.

WE BUY, SELL AND CUSTOM REPROCESS

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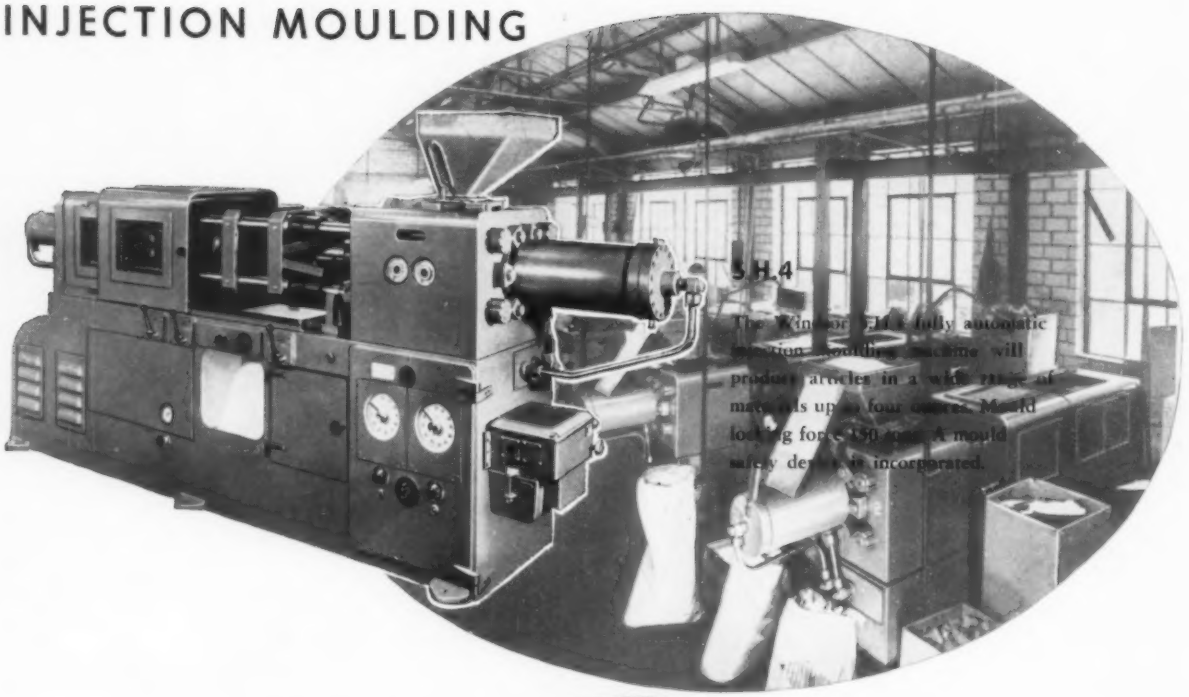
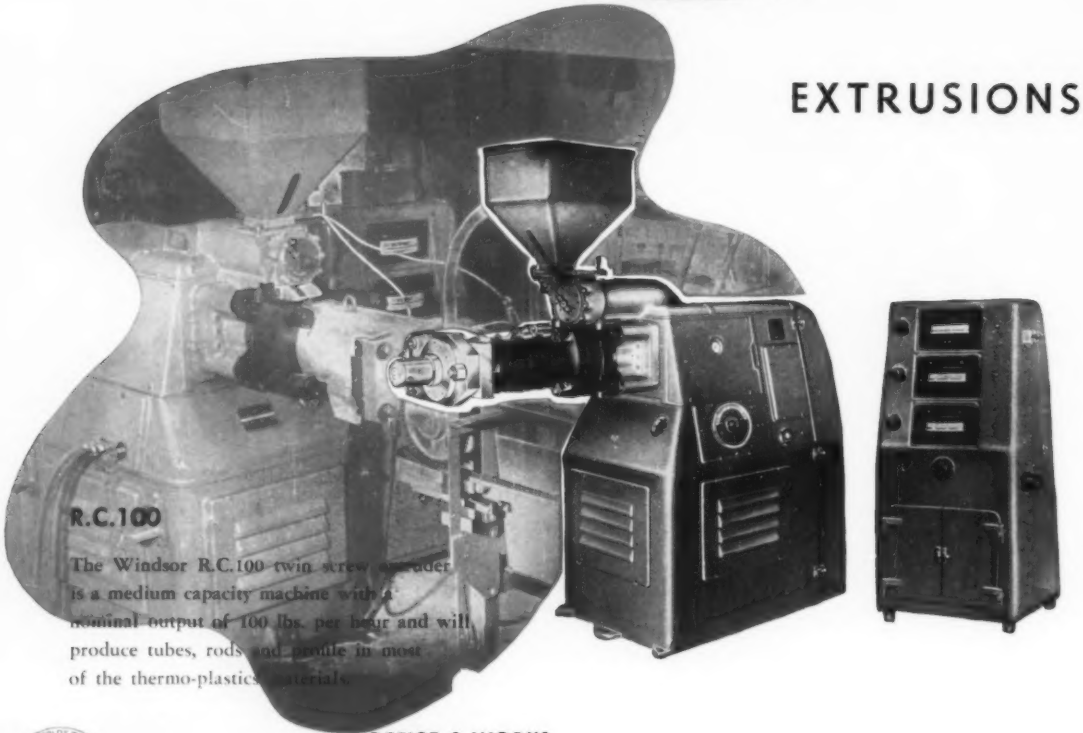
INJECTION MOULDING



S.H.4

The Windsor S.H.4 fully automatic injection moulding machine will produce articles in a wide range of materials up to four ounces. Mould locking force 150 tons. A mould safety device is incorporated.

EXTRUSIONS



R.C.100

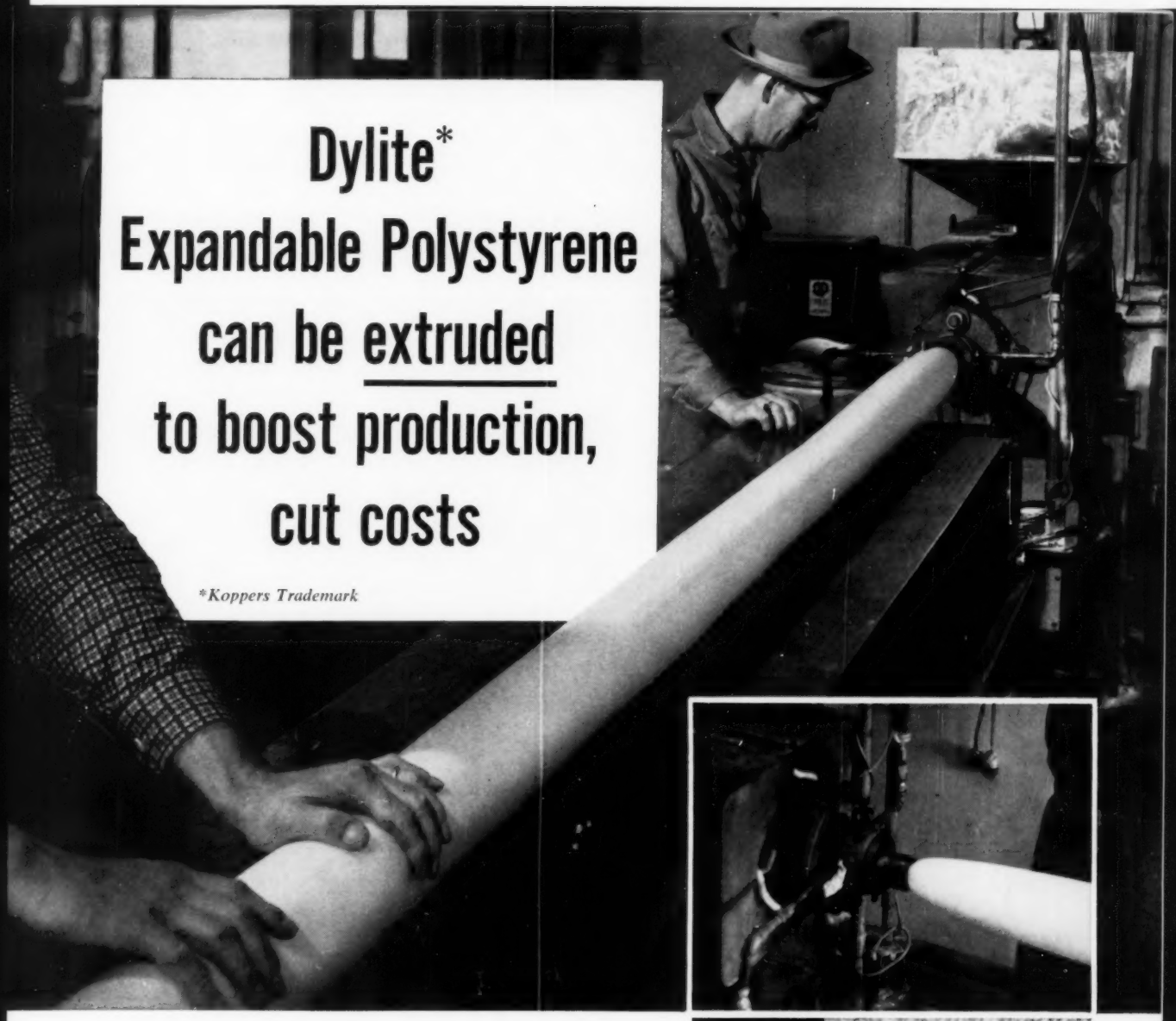
The Windsor R.C.100 twin screw extruder is a medium capacity machine with a nominal output of 100 lbs. per hour and will produce tubes, rods and profile in most of the thermo-plastics materials.

OFFICE & WORKS:

Leatherhead Road, Chessington, Surrey, England.

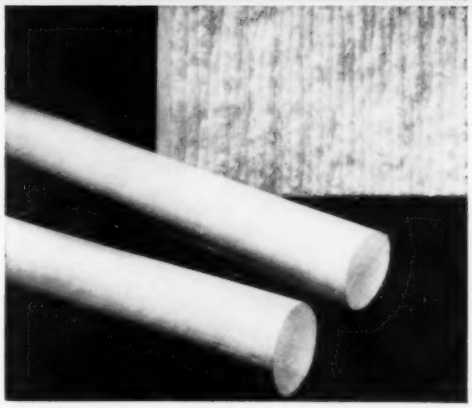
Windsor LTD

U.S.A. F. J. Stokes Machine Co., Philadelphia 20, Pennsylvania.
CANADA Wilmod Co., Plastic Division, 2488 Dufferin St., Toronto.



Dylite* Expandable Polystyrene can be extruded to boost production, cut costs

**Koppers Trademark*



Load a standard plastic extrusion machine with Dylite plastic beads by Koppers, and you can turn out foamed polystyrene sheets, rolls and tubes quickly, at low cost. Dylite sheets can be extruded with a smooth or corrugated surface.

For interesting and unusual design effects, Dylite rods can be bent into circles, wavy curves or conical shapes as they leave the extrusion machine.

This foamed plastic is easy to color. Simply dry mix a colorant with the polystyrene beads and you get a smooth, lightweight Dylite shape in any color you want.

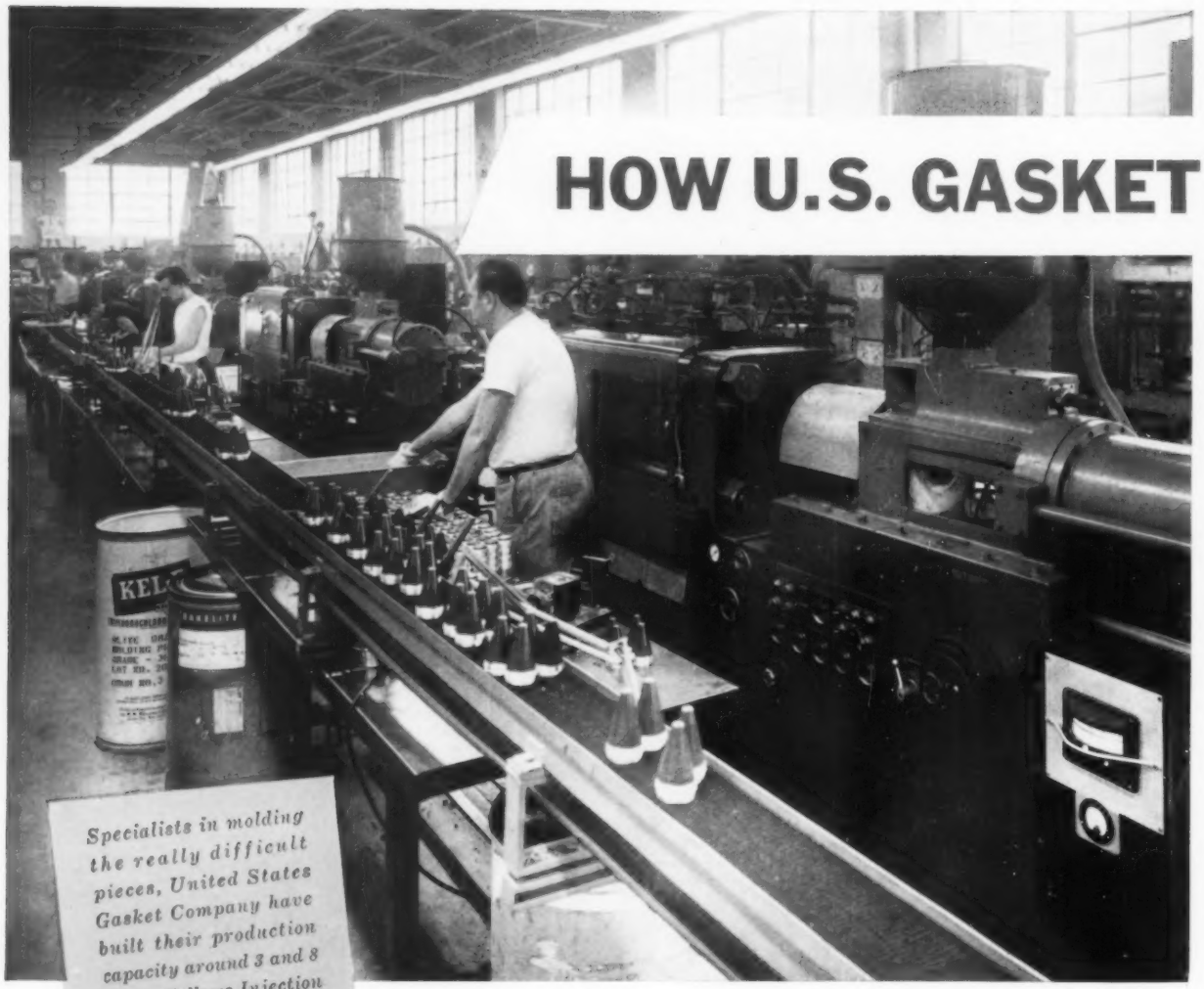
Extruded Dylite is perfect for pipe or board insulation and display and industrial packaging. Use it wherever strength, light weight, color and economy are important factors. Write for a copy of our free booklet.

KOPPERS

KOPPERS PLASTICS

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-85, PITTSBURGH 19, PENNSYLVANIA

SALES OFFICES: NEW YORK • BOSTON • PHILADELPHIA • ATLANTA • CHICAGO • DETROIT • HOUSTON • LOS ANGELES



HOW U.S. GASKET

Specialists in molding the really difficult pieces, United States Gasket Company have built their production capacity around 3 and 8 ounce Fellows Injection Molding Machines

Fellows injection molding machines

Exclusively using Fellows Injection Molding Machines... United States Gasket Company, Camden, New Jersey had the extremely sensitive heat control necessary for handling such plastics as KEL-F and BAKELITE FLUOROTHENE. They also had the highspeed injection rate required to properly fill the intricate mold cavity...the high cylinder and clamping pressures needed to keep the piece free of distortion...the machine rigidity and precision operation to hold the difficult tolerances, particularly on the I.D. and internal threads...and the fast action, automatic machine features that allow an economical pro-

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division. Head Office and Export Dept., Springfield, Vt. Branch Offices: 319 Fisher

LICKED A DIFFICULT MOLDING JOB

the problem:

To mold from either KEL-F or BAKELITE FLUOROTHENE an intricate switch body . . . maintain critical tolerances on all holes as well as on the I. D. and internal threads . . . hold shrinkage and distortion to a minimum . . . keep piece free of "sinks".

help to get the job done . . .

duction schedule. Most important, they could depend upon an extra high level of performance, week after week.

Whether you are faced with a problem involving the molding of difficult pieces in KEL-F, NYLON, FLUOROTHENE, etc. . . . or the mass production of low cost, consumer items . . . the Plastics Machine Specialist at any Fellows Office will gladly assist you. WRITE, WIRE or PHONE.

Fellows

injection molding machines

Bldg., Detroit 2—5835 W. North Ave., Chicago 39—2206 Empire State Bldg., New York 1—6214 West Manchester Avenue, Los Angeles 45

Puts your business on a cash basis

If you are a plastics manufacturer or a wholesaler with annual or potential sales of $1,000,000 or more you can profitably use our kind of banking service to provide increased working capital without increased indebtedness or dilution of profits.

Why not investigate this modern approach to your money problems and learn how you can put your business on an all-cash basis, with wider opportunities for sales and profits.

More than four hundred companies in various industries are now profitably using our banking services.

Textile Banking Co., Inc.

Providing operational financing for manufacturers and distributors of furniture, apparel, electronics, plastics and textiles.

55 Madison Avenue, New York 10, N. Y.

From National Aniline at Hopewell, Va. Substantial New Basic Production of

CYCLOHEXANONE

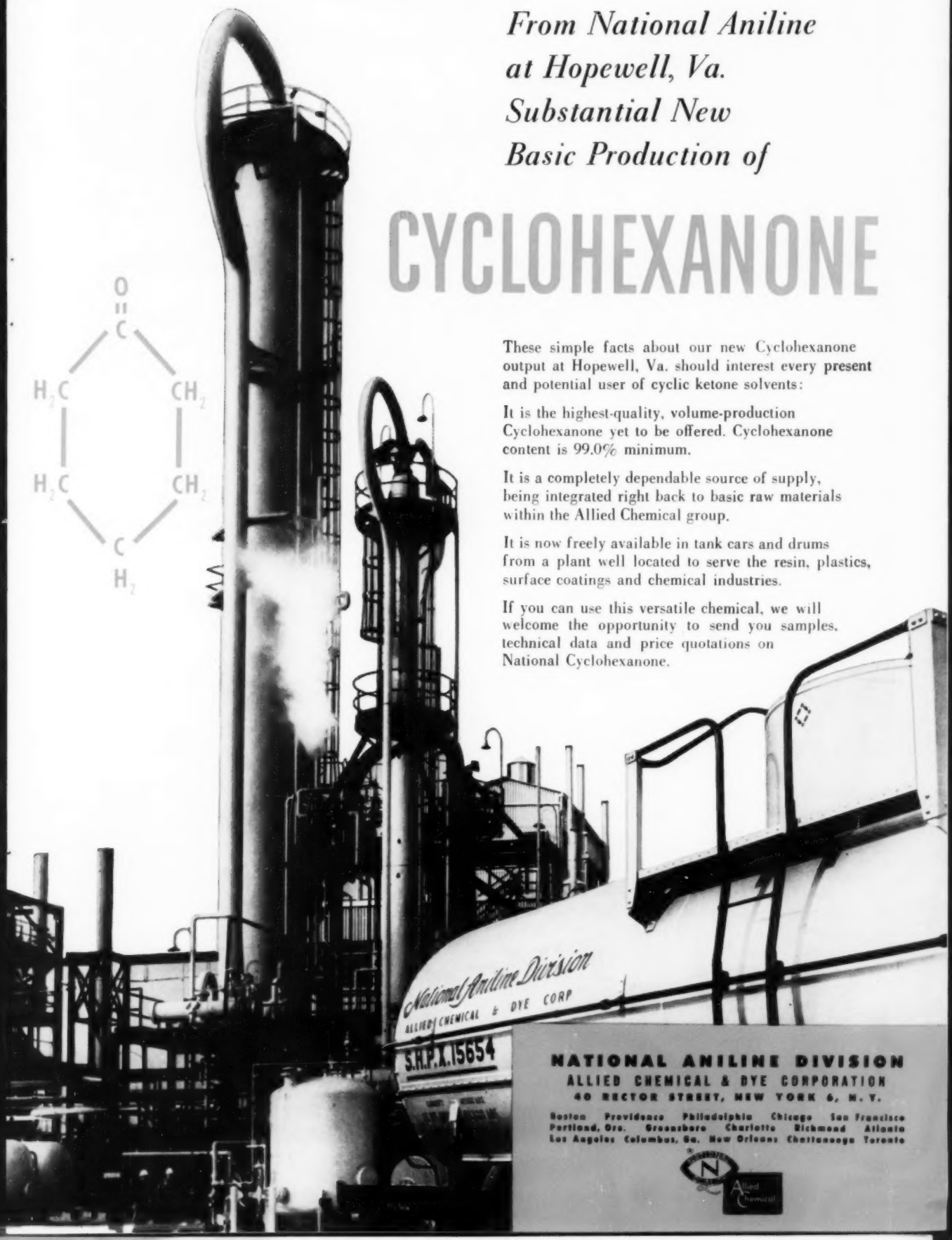
These simple facts about our new Cyclohexanone output at Hopewell, Va. should interest every present and potential user of cyclic ketone solvents:

It is the highest-quality, volume-production Cyclohexanone yet to be offered. Cyclohexanone content is 99.0% minimum.

It is a completely dependable source of supply, being integrated right back to basic raw materials within the Allied Chemical group.

It is now freely available in tank cars and drums from a plant well located to serve the resin, plastics, surface coatings and chemical industries.

If you can use this versatile chemical, we will welcome the opportunity to send you samples, technical data and price quotations on National Cyclohexanone.



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ALLIED CHEMICAL & DYE CORPORATION
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Portland, Ore. Greensboro Charlotte Richmond Atlanta
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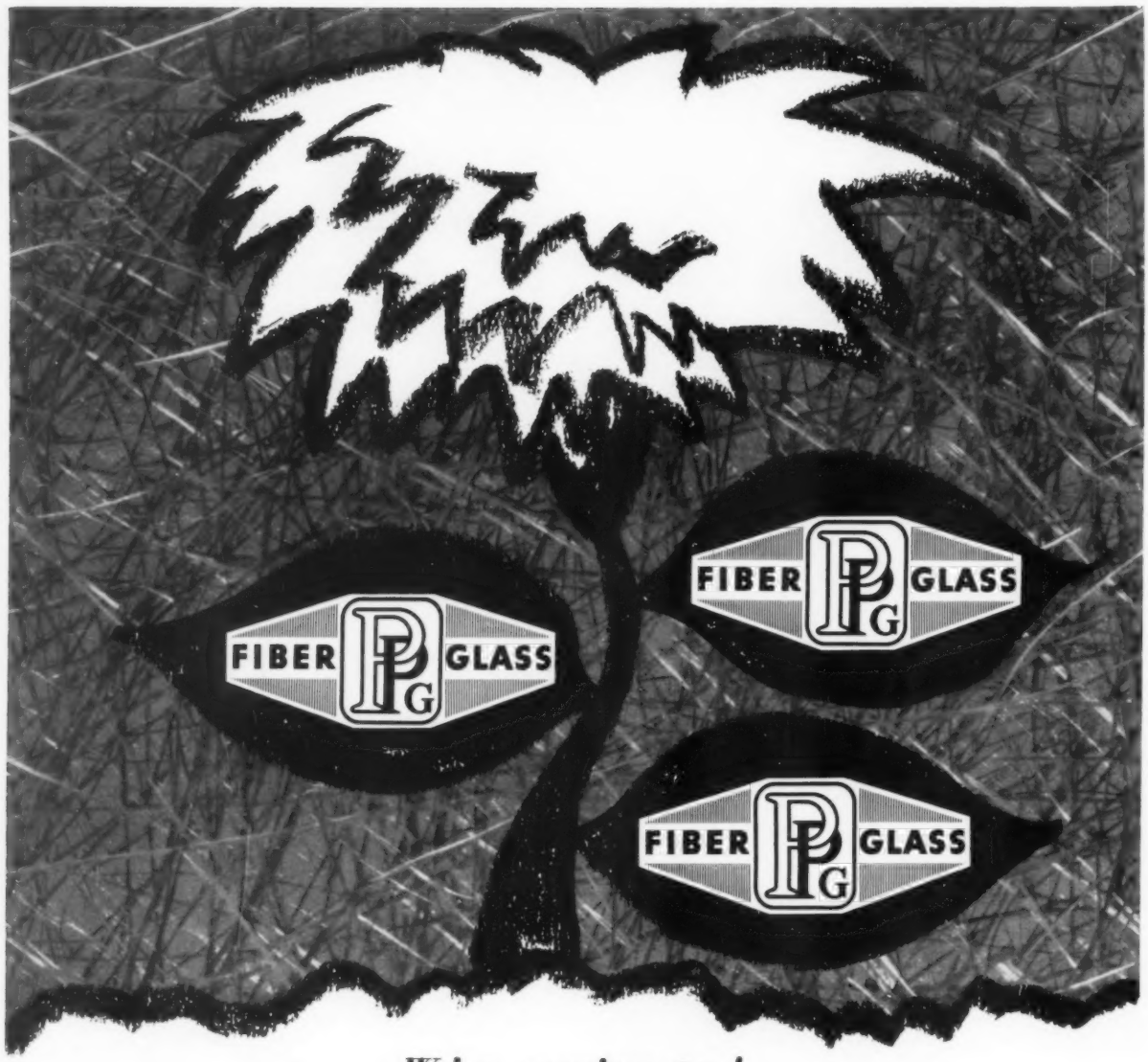
Allied Chemical



We're growing, too!

Like the rapidly expanding industry of reinforced plastics molding, PPG with its fiber glass products is growing, too . . . in improved product quality, in technical know-how, in experienced personnel.

That's why it can be extremely profitable to talk over your particular molding job with the local Pittsburgh Fiber Glass representative. While you know your molding problems best, he and the technical staff at Pittsburgh will work with you on the type and size of fiber glass that will best suit your molding job.

Take advantage of the new quality roving, chopped strands and yarns that have over 70 years of PPG "know-how" in glass making behind them—you can get complete details on PPG reinforcements and weavers of PPG reinforcement cloth by contacting our executive offices or district sales offices in Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia or St. Louis. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.

Get your copy of our new folder describing PPG reinforcements by writing our executive offices today.

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PITTSBURGH PLATE GLASS COMPANY

NEW! Powerful...Compact preheating apparatus—"Thermex 7R"

Sliding drawer is conveniently located for quick easy loading. Power is applied automatically when the operator closes the drawer, shuts off after a preset interval. The "7R" unit is rated at 7½ kilowatts.

Thermex®
PLASTIC PREHEATING APPARATUS

THIS NEW 7.5 kilowatt THERMEX* Preheating Apparatus can heat 6 pounds of general purpose material from 80° F to 250° F in just one minute . . . speed up your production by reducing mold closing and curing time.

Occupying only 7½ square feet of floor space, the "7R" is mounted on rubber-tired casters for easy portability. Simply roll it to the job, connect power, and you're ready to preheat. The unit is air-cooled, thus requires no plumbing.

When you choose THERMEX Preheating Apparatus you are wisely investing in the best. This equipment is backed by millions of hours of efficient operation of THERMEX High Frequency equipment in the plastics industry. Installations are made by THERMEX factory engineers. Each unit is certified in accordance with FCC regulations.

Write for complete specifications of the new "7R". If you wish, a THERMEX field engineer will study your operations and make recommendations. The Girdler Company, Thermex Division, Louisville 1, Kentucky.

*THERMEX — Trade Mark Reg. U. S. Pat. Off.

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
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There's Fresh Scope For Profit

in

Kleestron H

high impact polystyrene

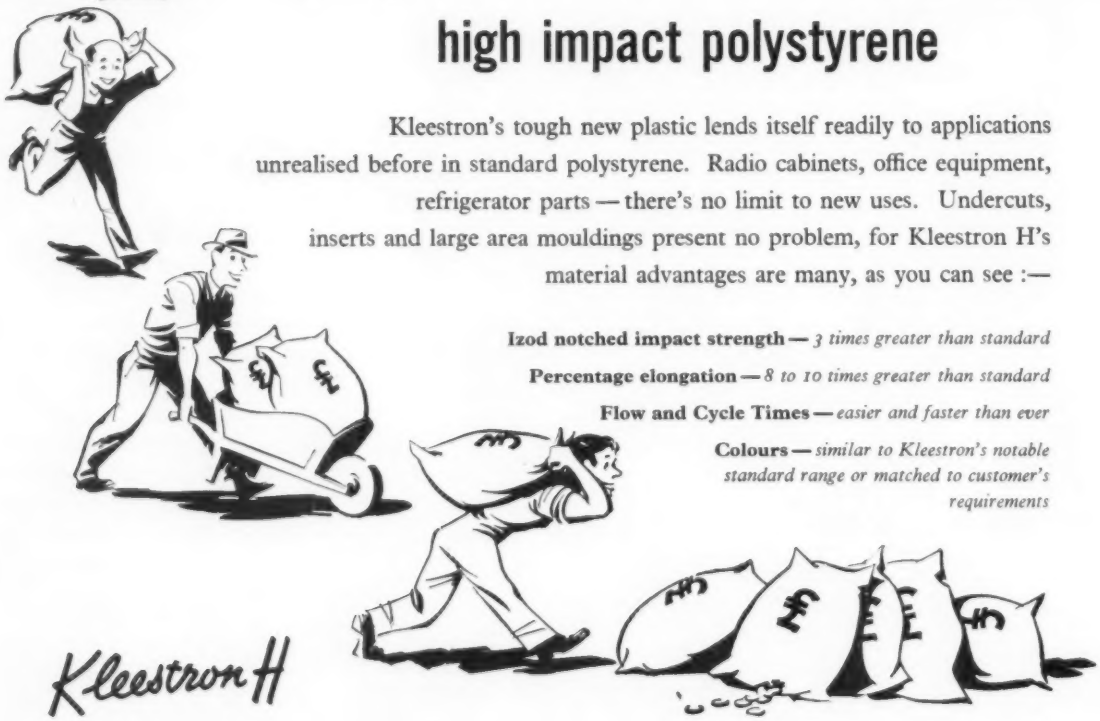
Kleestron's tough new plastic lends itself readily to applications unrealised before in standard polystyrene. Radio cabinets, office equipment, refrigerator parts — there's no limit to new uses. Undercuts, inserts and large area mouldings present no problem, for Kleestron H's material advantages are many, as you can see :—

Izod notched impact strength — *3 times greater than standard*

Percentage elongation — *8 to 10 times greater than standard*

Flow and Cycle Times — *easier and faster than ever*

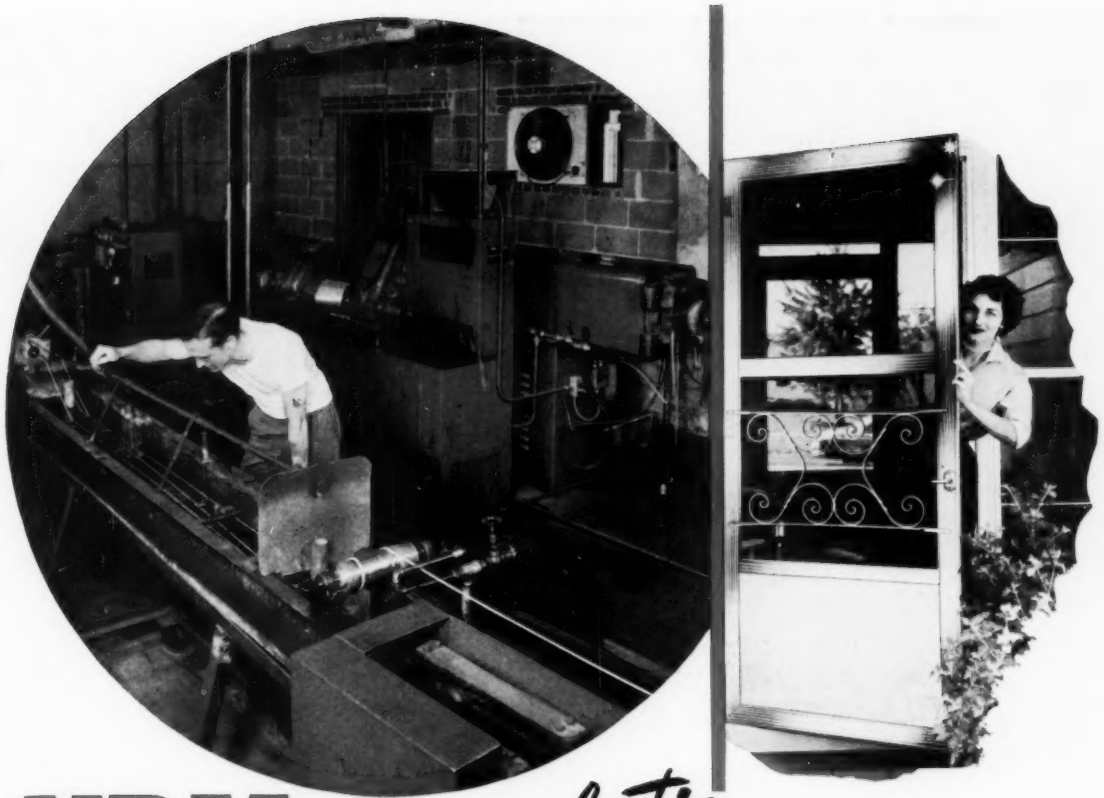
Colours — *similar to Kleestron's notable standard range or matched to customer's requirements*



Kleestron H

is available in
extruded pellet form for injection moulding

KLEESTRON LTD · West Halkin House · West Halkin Street · London · SW1 · 'Phone: SLOane 0866



NRM *Thermoplastic* EXTRUDERS

PRODUCE THE HIGH QUALITY GLAZING EXTRUSIONS USED IN *ALSCO* ALUMINUM WINDOWS AND DOORS

Alsco, Inc., with plants throughout the United States, Canada and Europe, is the world's largest manufacturer of all-aluminum windows and doors. The photo shows GEON* glazing extrusions being produced on NRM Extruders in Alsco's Akron, Ohio, plant. We got this reply when we asked Alsco for a report on the performance of their NRM's:

"Only highest quality plastic extrusions of true dimensions are acceptable for Alsco windows and doors," stated Mr. E. B. Peterman, Plant Manager. "That's why we selected NRM Extruders when we decided to produce our own glazing plastics. We knew of the NRM reputation for high output of top quality extrusions at low operating cost. Through the years our NRM's have certainly lived up to this reputation. When we ordered more Extruders recently, they, too, were NRM's."

At NRM we're happy to know from companies like Alsco, Inc., that the reputation of our Extruders for "high quality extrusions at low operating cost" is so well known, even outside the plastics industry. If *you* extrude thermoplastics in any form or quantity, take a tip from leading manufacturers like Alsco and do it at greater profit with NRM Extruders and Equipment. We'll be happy to send you full details on the advanced NRM design and construction features which assure this result. Write today. There's no obligation.

*Reg. T. M. of B. F. Goodrich Company

2337

NATIONAL RUBBER MACHINERY COMPANY

NRM

Creative Engineering

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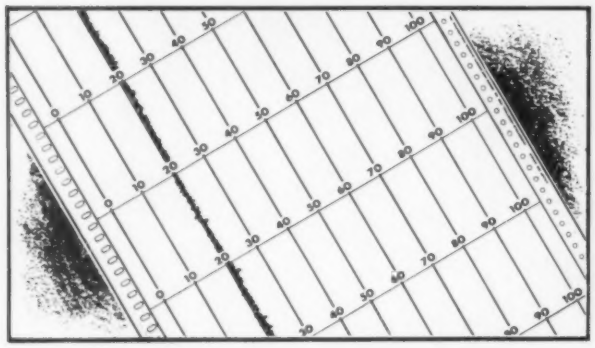
PRESTO PLASTICS GETS UNIFORMITY LIKE THIS WITH TRACERLAB BETA-GAUGE CONTROL



Presto Cuts Rejects 90% Gets Higher Quality at Lower Cost with NUCLEAR ENERGY

One of the biggest problems in the manufacture of plastic sheet is maintaining accurate, uniform gauge . . . proper thickness across the width of the roll and from beginning to end. Adopting Tracerlab Beta Gauging as a means of controlling quality level, Presto Plastics — leading manufacturer of high quality vinyl sheet — has solved this problem with industry's most modern tool: **Nuclear Energy.**

With Tracerlab Beta Gauge equipment, Presto now maintains precise gauge and uniform flatness within plus or minus 2½% on sheet thicknesses that are measured in thousandths of an inch! Rejections due to "off spec" gauging have been cut 90%, and the overall rejection rate from all causes has been halved. Time required to change gauge between runs of different products has been reduced to ⅓ the time formerly consumed by manual methods. Changeover now occupies only 5% of operators' time on the line. In addition, production per shift has increased significantly since it is no longer necessary to stop the machine periodically to check gauge and adjust the rolls.

A comparison of old and new methods shows how these savings are made:

Old Method: Manual Gauging. At the start of a production run the operator had to set the calender rolls approximately, run a sample of material, shut the machine down, then gauge manually across the width of the sheet. He then adjusted the controls, ran another sample and repeated the process until thickness came within tolerance.

At intervals during the run, the operator gauged the edges of the sheet in order to maintain specifications since drift away from standard meant the production of unsalable goods. It was extremely difficult for manual gauging to detect drift away in time for corrections to be applied to the roll of plastic in process.

Programming of production for orders of various sheet widths or thicknesses called for repetition of the start-up procedure, with consequent production delays. Uniformity of product from roll to roll and day to day was difficult to maintain because of the large personal element involved in gauging. Much depended upon the operator's skill and experience. For embossed goods manual gauging was highly unsatisfactory due to the irregular surface.

New Method: Beta Gauging. Two Tracerlab Gauges mounted on the windup tower scan each edge of the sheet continuously (fig. 2). Each unit has a remote indicating meter at the machine control panel for convenience in making operating adjustments. In addition, pen recorders located at a separate station furnish permanent records of quality, (see fig. 3)

To start a production run, the operator merely sets the calender rolls for the desired thickness using the Beta Gauge indicator and starts the machine. As sheet is produced he makes minor adjustments "on the fly" to keep the meter on the control panel at the correct reading. "Drift" during the run is indicated instantly by the meter and the operator quickly readjusts the roll to keep thickness within tolerance without loss of production. As specification for

Fig. 2. Pair of Tracerlab Beta Gauges provides continuous quality supervision of plastic sheet leaving calender rolls. Control of thickness, flatness and weight is exceptionally accurate. Rejections due to errors of thickness are down 90%.

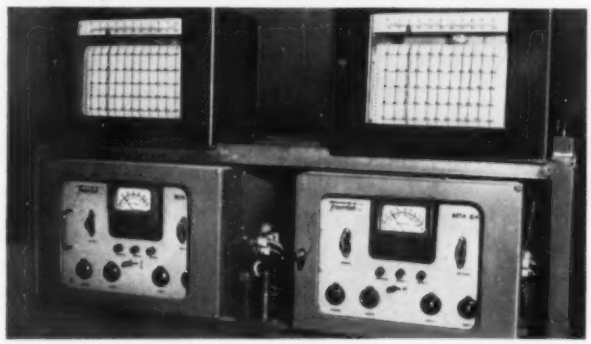


Fig. 3 Control panel and recording indicator furnish continuous record of thickness. "Drift" away from spec can be corrected quickly. With permanent visual record, supervision is minimized, and operators can give attention to other critical quality factors.

thickness or weight changes between production runs, it is a simple matter to reset the Beta Gauge and adjust thickness "on the fly".

For embossed goods, Beta Gauging is the only accurate, satisfactory means of measuring thickness and getting maximum yield.

The permanent record provided by the Tracerlab equipment has reduced the need for close personal supervision. The production superintendent has a continuous record of production rate, quality and performance of each shift.

Production workers like the new system because it eliminates frequent, tedious mechanical gauge checks and permits them to spend more time checking other critical elements such as color and winding.

Management likes the Tracerlab installation because operating a Beta Gauge requires no special skill, and training of new machine tenders is minimized.

Because of its rugged, industrial type construction, the Tracerlab equipment requires little attention, despite the fact that the gauge is subject to constant vibration. Presto estimates only one hour per week is required for preventive maintenance and gauge standardization.

If you have a problem that involves control of thickness or weight per unit area, Tracerlab will be glad to show you the advantages of Beta Gauging . . . an application of nuclear energy.

Write today — see how Tracerlab can help you.

Tracerlab KELEKET

Tracerlab

130 HIGH ST., BOSTON 10, MASS.
2030 WRIGHT AVE., RICHMOND 3, CALIF.

Stabilized with Lectro "60", vinyl insulations pass immersion tests with flying colors.

Now "Dutch Boy" research brings you

Lectro "60"

unique stabilizer for vinyl insulation

- **Disperses with ease!**
- **Excellent electrical properties!**
- **Reduces volume cost!**
- **Repels water!**

Now it's here . . . in full production . . . a brand new lead complex. "Dutch Boy" Lectro "60".

Outstanding for water repellency. "Dutch Boy" Lectro "60" is insoluble and completely non-absorptive . . . actively repels water penetration. Prevents porosity. What's more, it demonstrates excellent volume resistivity over a wide range of temperatures. When TW and comparable vinyl insulations are stabilized with *Lectro "60"*, they pass immersion tests with flying colors.

Great ease of dispersion. "Dutch Boy" Lectro "60" resists penetration by water but welcomes plasticizer wetting – shows remarkable ease of dispersion. In vinyl insulation compounds, it shows excellent extrusion properties . . . no moisture pick up . . . no gassing. And with most plasticizers it is non-reactive. Excellent compatibility.

Low volume cost. "Dutch Boy" Lectro "60" has much lower specific gravity than other primary basic lead stabilizers.

You get "Dutch Boy" Lectro "60" commercially as a fine white powder in 50-lb. bags. But for sampling purposes the carton shown is packed with 1½-lbs. If you would like one of these free sample packages, just write.

For free sample – write:

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N. Y.
In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West · Montreal

For High Speed Injection Molding *investigate the* MOSLO *line*

Duplimatic—2½ ounce machine, especially suited for high speed production of molded cord plugs and parts requiring inserts.

You'll be amazed at the performance

For their size, Moslo Injection Molding Machines have tremendous plasticizing capacity.

Everywhere, Moslo machines are making daily production records. They are equipped with the latest automatic controls, ruggedly constructed, and operate at speeds that make production profitable. In many instances the Moslo Super 2 ounce out produces machines of 2 to 4 times its capacity.

Write today for additional information. Better yet, let us arrange a demonstration for you in our plant where you can see these machines in operation. If you see them, you'll buy them.

Check These Features

1. Plasticizing capacity highest for its size.

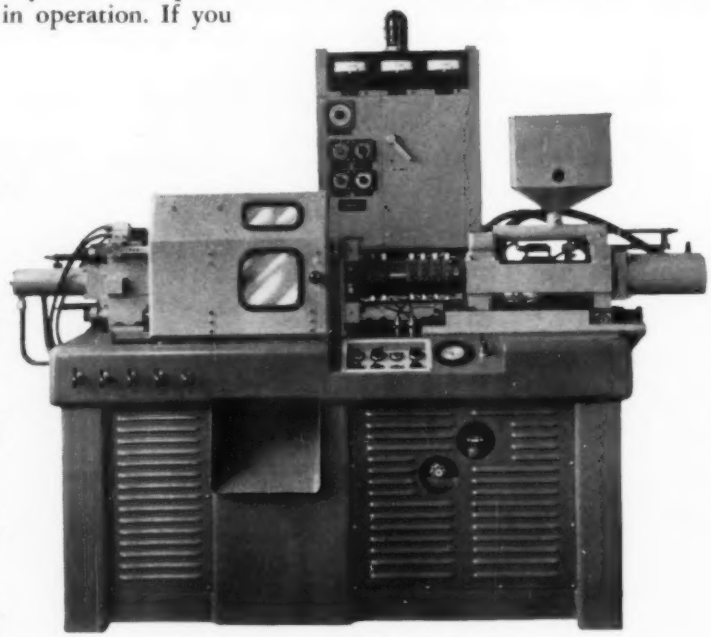
2. High speed production.

3. Hydraulic manifold eliminates 60% of fittings and simplifies maintenance.

4. Heavy duty, welded steel base and heavy gauge materials provide sturdy and rugged construction.

5. Automatic controls and safety devices assure maximum protection to operator, material and machine.

6. Built into every Moslo machine are many exclusive fectures that have been developed from years of experience in the plastic molding machinery business.



Illustrated is Model 74, fully automatic, Super 2 ounce machine. Also available, Model 73, Standard fully automatic, 2 ounce machine and Model 75, fully automatic, 3 ounces.

MOSLO MACHINERY COMPANY

2437 PROSPECT AVENUE • CLEVELAND 15, OHIO

All the world over –'PERSPEX' sells the goods

'PERSPEX' is pre-eminent for advertising display signs—tough, good-looking, stands up to every kind of weather. It's available in clear and opal sheet, or in a wide range of transparent, translucent and opaque colours.

One of the first uses of 'Perspex' was in aircraft shapings. It is used for motorcycle windshields and it is a main feature of the Messerschmidt 2-seater car illustrated below. The signs illustrated are Italian, Peruvian, Canadian and Indian. 'Perspex' means the best in any language.

'PERSPEX'

is the registered trade mark for the acrylic sheet manufactured by I.C.I.

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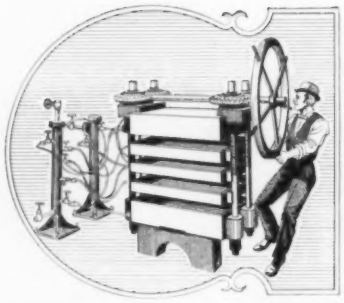
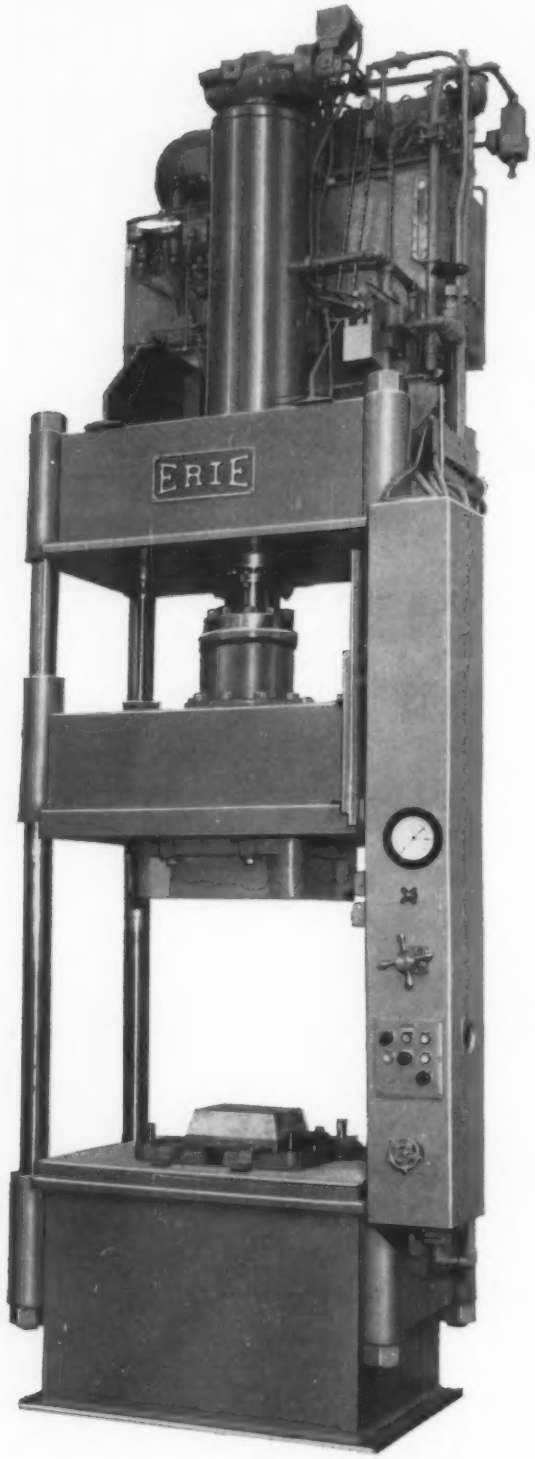
ICI

in the good old days

when Grandpa molded on this screw-operated press . . .





when one of the big names in the rubber industry was Goodrich-Tew & Company

ERIE FOUNDRY COMPANY WAS A GREAT NAME IN COMPRESSION PRESSES

in today's plastic shop

Fiberglass is molded on ERIE Presses that anticipate all possible requirements in reinforced plastics molding. This ERIE semi-automatic, self-contained press can be arranged with *three* closing and *two* opening speeds and tonnages. In a five-speed cycle, the ram meters down in high speed from the top of its stroke—stroke length is adjustable too—automatically moves into an intermediate speed and presses at low speed. Pressing speed and pressure apply when the material is contacted. After curing, the ram starts upward at low speed—adjustable from 0 to maximum—with high stripping tonnage applying to open the toughest mold. After die break-away the ram moves into high return speed. ERIE Press shown is down-acting. Up-acting rams are optional.

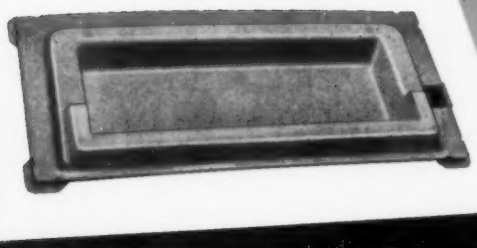
ERIE Fiberglass presses produce more perfect pieces per hour. Write for bulletin.

in our 60th year

ERIE

Today, the greatest name in specialized compression presses

ERIE FOUNDRY CO. ERIE, PA.



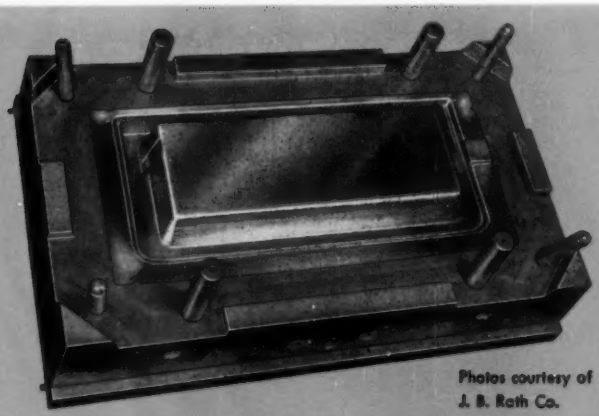
For the cavity for this refrigerator door panel mold . . .

J. B. Rath Co.
Van Dyke, Mich.

reports this about . . .

Cascade
prehardened MOLD STEEL

1. Machinability equal to other popular prehardened steels.
2. Polishability was excellent.
3. Excellent weldability of Cascade was noted on engineering changes.



Photos courtesy of J. B. Rath Co.

In the above application, the portion of the mold built of Cascade is the critical cavity. Cascade's uniform hardness throughout the entire 6″ x 20″ x 36″ section assures strength in all critical areas.

Cascade's excellent finishability and weldability (a result of Cascade's precipitation hardening metallurgy) have been noted by many leading molders and moldmakers. These properties, together with others, make Cascade a preferred choice among prehardened steels for plastic injection molds where highest quality is demanded.

Call your Latrobe representative today . . . specify Cascade steel on your next mold . . . generous warehouse stocks available to serve you or your moldmaker.

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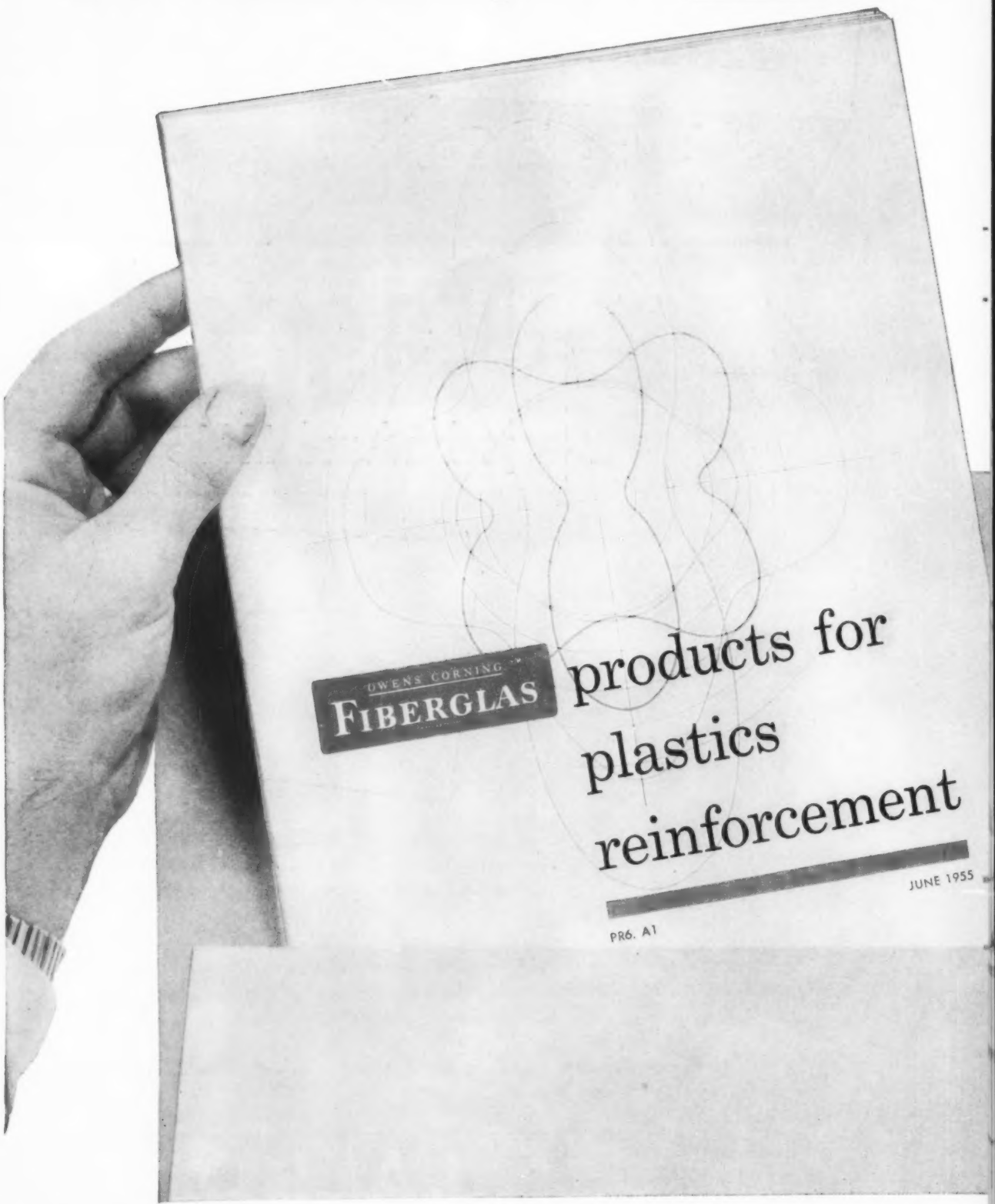
New booklet sparks ideas in



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28 pages of invaluable information on properties of molded products . . . representative applications . . . resins and molding processes . . . and basic data on Fiberglas products: mats, roving, chopped strands, milled fibers and yarns . . . plus a complete section on the latest addition to the FRP product family—Fiberglas-Reinforced Molding Compounds.

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End-Product Manufacturers, Industrial Designers and Product Engineers will find this free booklet an invaluable source of ideas on FRP . . . where to use it and how to use it. Compiled by the Owens-Corning Fiberglas Technical Service Department . . . at your service to assist and advise on applications of these materials.

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Meet the NEW CHAMP! *

* **the IMPROVED fully automatic LEWIS "4"**

New automatic operation . . . new capacity . . . new controls . . . new power plant . . . and new production savings are *standard* features of the improved Model "4".

This fast-operating LEWIS machine molds up to 4 ounces of polystyrene . . . permits "hands off" production of intricate parts . . . requires minimum maintenance.

Super-sensitive low-pressure closing controls assure complete safety for operators and molds. Featuring infinitely variable adjustment, these controls permit fast closure of moving platen with very low hydraulic pressure . . . stop machine instantly if platen meets slightest resistance before reaching a pre-set limit switch.

FOR COMPLETE DETAILS, WRITE FOR NEW BULLETIN 104 . . . or call BEdford 2-2500.

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THE LEWIS WELDING & ENGINEERING CORPORATION
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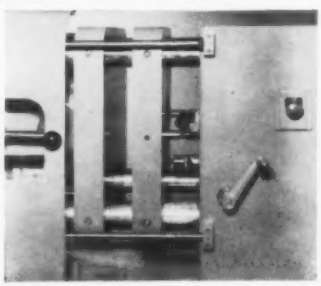
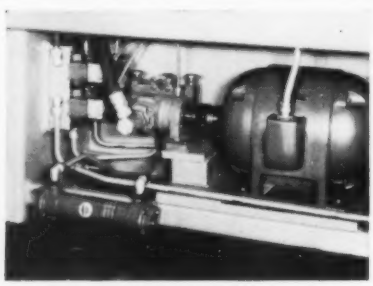
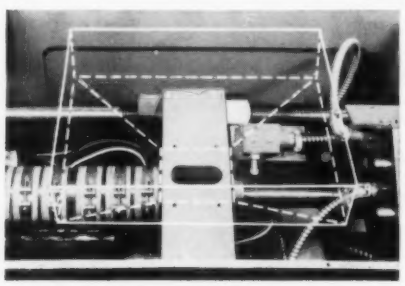


QUICK-OPENING DIE-LOCK DEVICE permits clearing of jammed nozzle in 20 seconds or less.

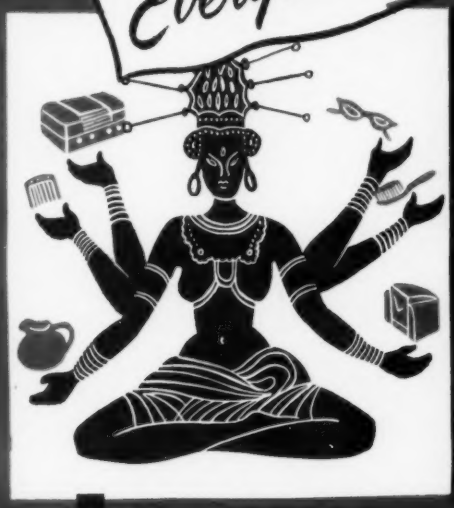


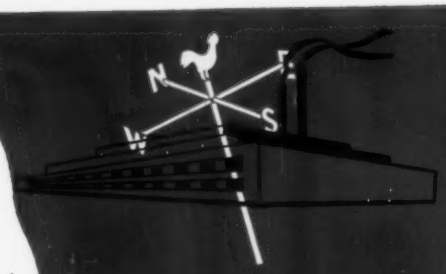
20,000-LB. INJECTION PRESSURES are developed by new 10 H.P. motor and new larger pump.



COMPENSATING FEED MECHANISM meters material to meet varying production requirements.

Memo
alert molders Everywhere!





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Special Effects....

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MOTHER-OF-PEARL
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The rich appearance and beauty of molded items made from
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"Gering engineering makes fine plastics better"

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PLASTIC MATERIALS

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CABLE ADDRESS: GERING KENILWORTH, N. J.

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all pumping equipment in one compact assembly

CUSTOM BUILT AT LOWEST PRICE . . .
job engineered from standard components

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of special welded fittings and seamless tubing

TAKE A BIG LOOK

at Columbia Hydraulic Compression Moulding Presses

PRECISION CONSTRUCTION . . .
for more production, fewer rejects

Every Columbia Hydraulic Compression Moulding Press feature assures easy operation, high output, quality production and minimum maintenance. These characteristics are important to profitable production of compression moulded parts.

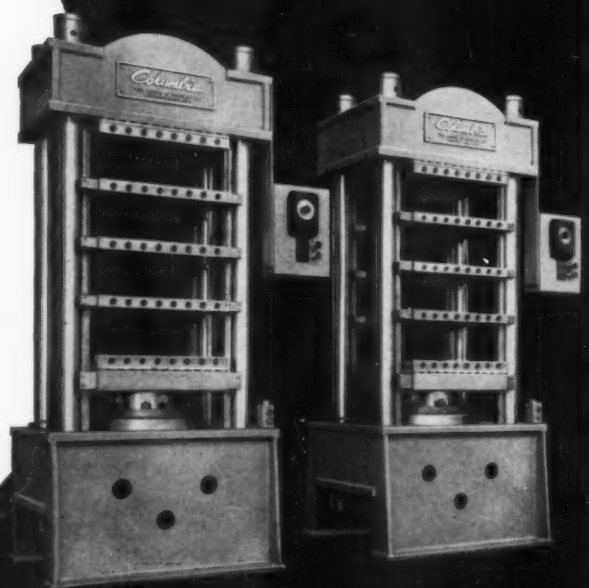
Consider the construction of the base and crown. Ruggedly made of heavy steel plate, the design of these parts absolutely minimizes deflection. Alloy steel strain rods have heavy, fine-thread nuts with special locking devices. The pressure platen is guided by the cylinder and by all four strain rods.

For higher production and quality, lower cost and maintenance . . . take a **BIG** look at Columbia features!

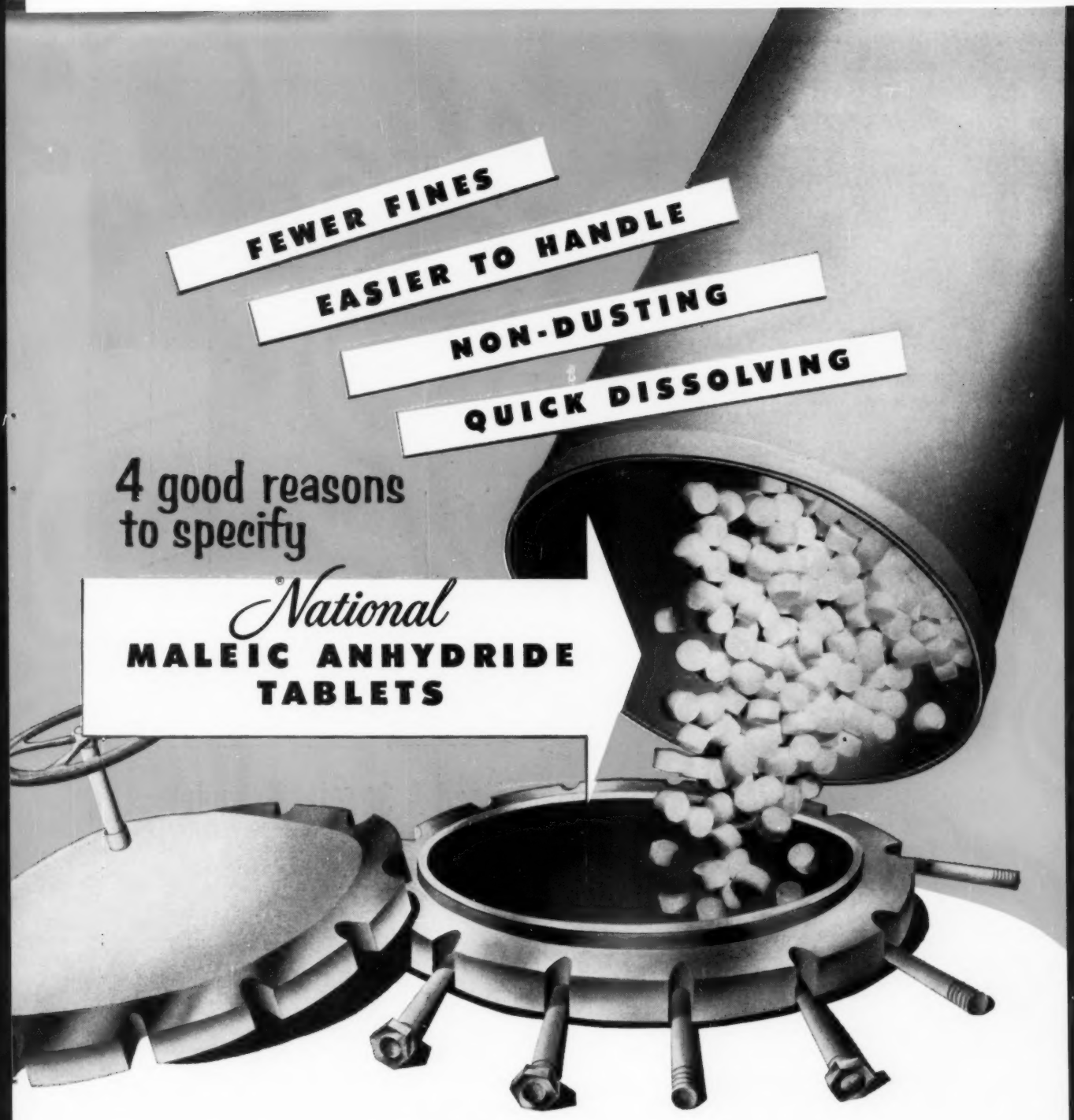
Write for FREE Bulletin HP-8 and the name of your nearest distributor

THE **Lodge & Shipley** COMPANY

HAMILTON DIVISION • Hamilton 12, Ohio



COMPRESSION MOULDING PRESS • 250 TON PRESS
Platen Size 24" x 24" with 4 daylights



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National MALEIC ANHYDRIDE TABLETS

These are the solid reasons why National Maleic Anhydride Tablets are setting the new standard of excellence for the industry.

Qualitative screen-analysis proves these tablets have up to 90% fewer fines "as delivered". Quick dissolving, uniform, easier-to-handle National Maleic Anhydride Tablets are the best value your money can buy. And there's no price premium on this premium product.

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Allied Chemical

NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
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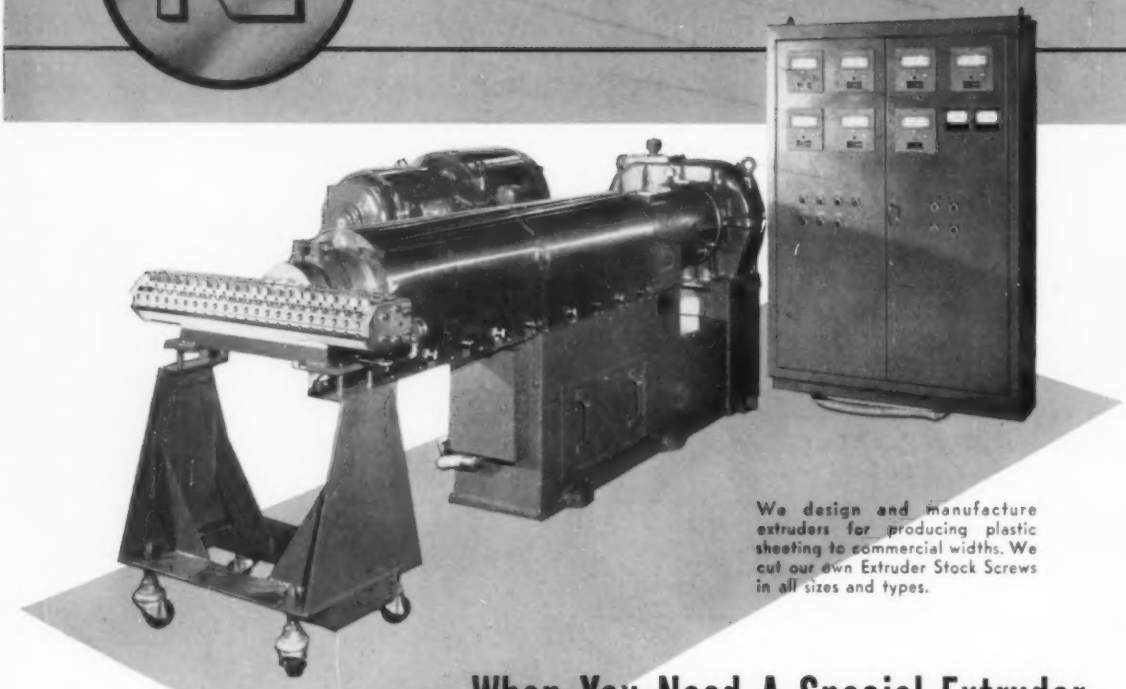
Craftsmen of the 20th Century

NE EXTRUDERS



We design and manufacture extruders for producing plastic sheeting to commercial widths. We cut our own Extruder Stock Screws in all sizes and types.

When You Need A Special Extruder For Your Individual Need—THAT'S OUR SPECIALTY

Your need may be a special feed or a volatilizing section. You may be considering a special material which will demand a special extruder. Or the shape of the extrusion may require a special opening and head.

Whatever the specific need for your extruder, we can engineer the unit for you.

That's our specialty — extruders with engineering — extruders for specific purposes.

The National Erie line has been in existence since 1902. Aetna-Standard, an outstanding manufacturer of machinery, bought the line of machinery in 1952. The NE line is sold by Aetna-Standard's sales associates, Hale and Kullgren, Inc. Send your inquiry to Hale and Kullgren, Inc., 613 E. Tallmadge Ave., Akron 10, Ohio.

WE STOCK PARTS

Stocking of parts speeds delivery on NE extruders. Send your inquiry to Hale and Kullgren, Inc., 613 E. Tallmadge Ave., Akron 10, Ohio.

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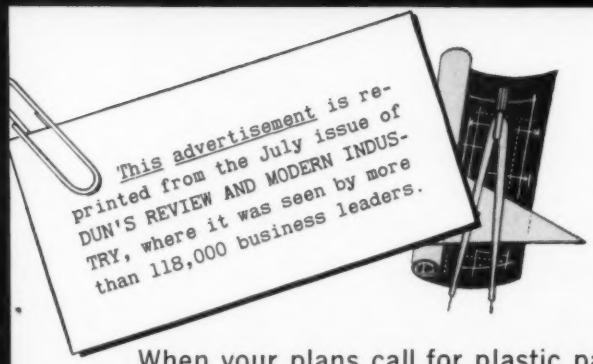
THE AETNA-STANDARD ENGINEERING CO., PITTSBURGH, PA.

PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.

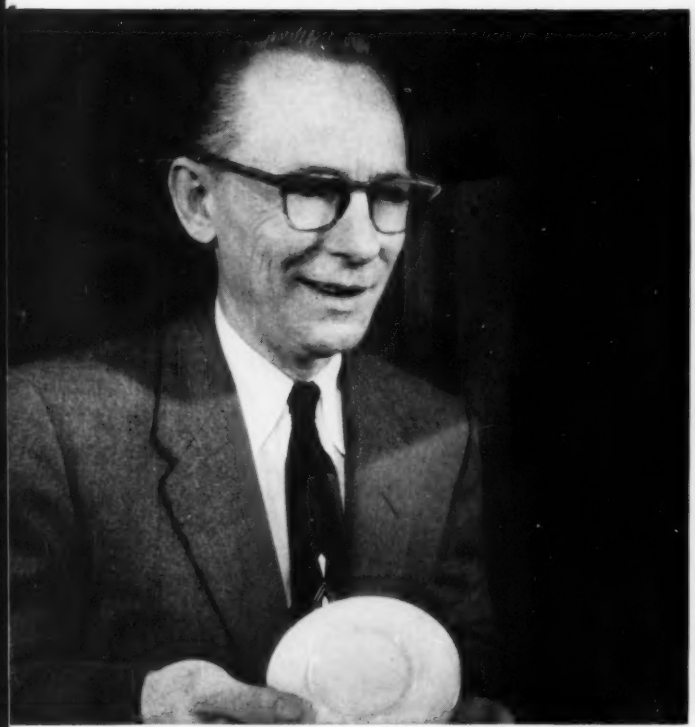
Craftsmen of the 20th Century

No. 5 of a series to introduce you to some of industry's outstanding plastics craftsmen


This advertisement is reprinted from the July issue of DUN'S REVIEW AND MODERN INDUSTRY, where it was seen by more than 118,000 business leaders.

Inspired by the materials at hand, the artisans of other ages fashioned masterpieces of glass and steel, wood and silver.
Today a whole new family of versatile materials is challenging a great new group of craftsmen. Their skills and imagination are creating plastic products that are serving every industry, every home.
Two of these "20th century craftsmen" are pictured on this page.
Monsanto, a major producer of high-quality plastic materials, salutes these men who are helping to mold America's tomorrow.

When your plans call for plastic parts or products, consult an expert custom molder



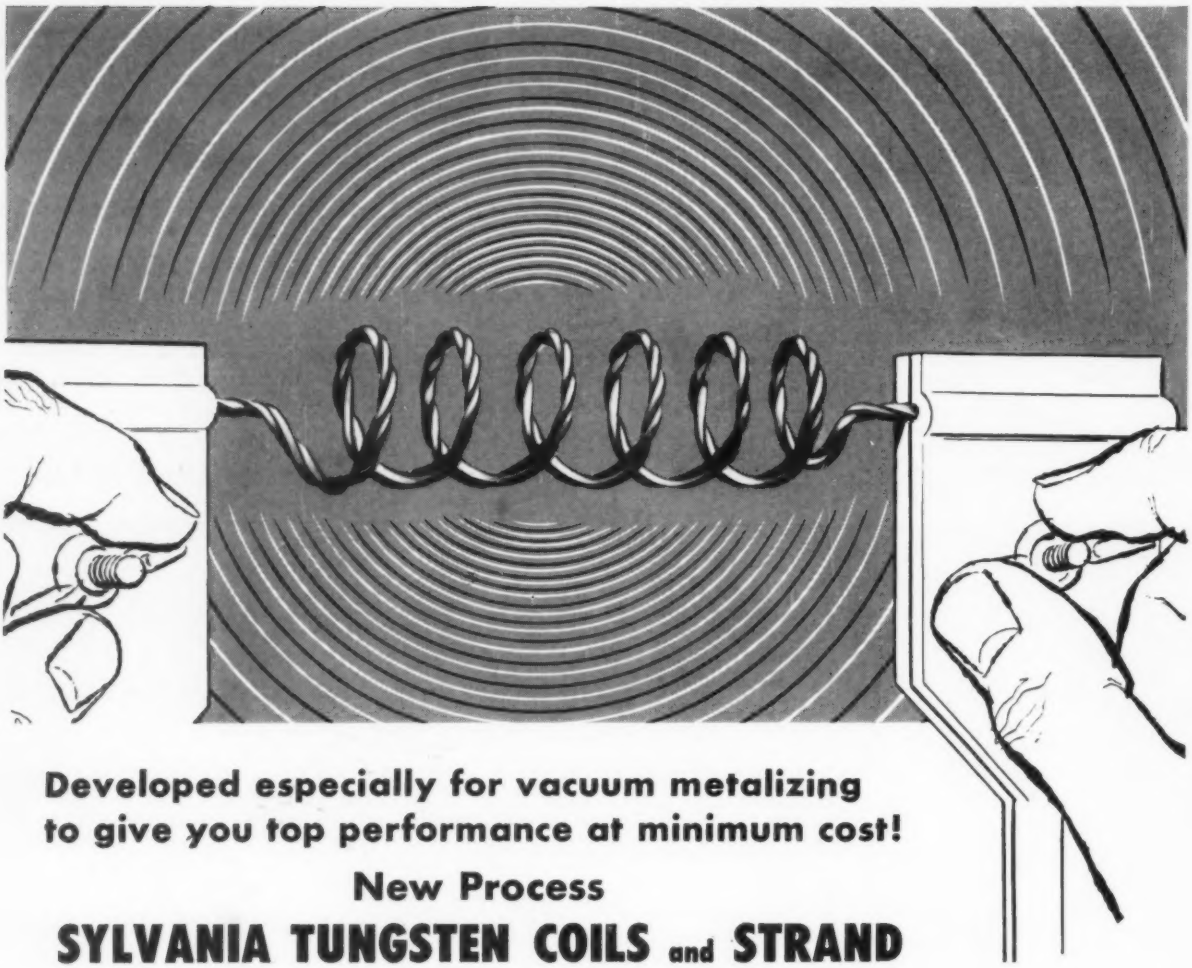
Merle L. Grob, Peoria Plastic Co., East Peoria, Ill. After six years as Chief Engineer at Peoria Plastic, Mr. Grob reports he has yet to find two jobs alike. Responsible for his company's mold designs and efficient operation, he brings to plastics engineering a background in heavy industry. An early innovation in his shop was to use "O" rings on the mold to permit a freer circulation of water and maintain a more uniform mold temperature. Cycle time on the first job run was cut 75%! Mr. Grob was also one of the pioneers of air ejection, contriving a pin of 1/32-inch piano wire that leaves practically no mark on the molded piece.

Norman Davis, Majestic Molded Products, Inc., Bronx, N. Y. With time out to serve in the Air Force during World War II, Mr. Davis has been pioneering improvements in the molding of plastics since 1939. He joined Majestic Molded Products 7 years ago and is now Vice President and General Manager, overseeing 135 employees. He remembers when a 6-oz. shot was a big job. Today Majestic is molding 200-oz. shots and has a 400-oz. machine on order. Mr. Davis predicts "real progress in custom-molded components is just beginning. More and more industries are learning about the sound engineering properties of plastics."

MONSANTO CHEMICAL COMPANY,
PLASTICS DIVISION, SPRINGFIELD 2, MASS.

MONSANTO

LUSTREX
Styrene Plastic



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New Process
SYLVANIA TUNGSTEN COILS and STRAND

To help you get more shots per dollar in vacuum metalizing, New Process Sylvania source heater materials are produced under exacting standards of uniformity throughout every step of manufacture. From tungsten ore to finished coils and strand, every production operation is done in Sylvania's own plants.

Special tungsten wire is coiled specifically for vacuum metalizing to assure both maximum evaporating capacity and long service life. Sylvania offers you a wide selection of ready-made tungsten coils, in single or multiple strand, each designed for a specific metalizing application.

If you prefer to form your own source heater coils, there are a full range of wire diameters and types to choose from. Whenever you encounter special application problems, our engineers will gladly help you work them out. Write for your copy of the newly published *"New Process Sylvania Tungsten Coils and Strand,"* presenting latest application and performance data.

SYLVANIA ELECTRIC PRODUCTS INC.
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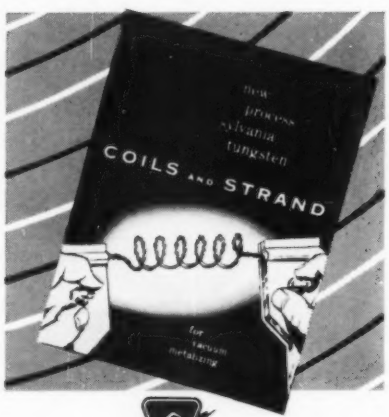


SYLVANIA®

Lighting • Radio • Electronics • Television • Atomic Energy

ELMES Presses *"maintain high quality of our product...leave nothing to be desired"*

Shown above are four of the six 225-ton Elmes Automatic Hydraulic Molding Presses which have been in continuous operation for nearly ten years at the Chicago Molded Products Corporation, Chicago, Ill. Mr. R. H. Goranson, Superintendent of the Georgetown plant, reports:

"The automatic feature on these presses has been a valuable help in maintaining the high quality of our work. Once the optimum cycle for a job has been determined, that cycle is accurately maintained, free from guesswork or human error.

"Mechanically, the presses have left nothing to be desired. Their rigidity maintains precise dimensions and tolerances. Mechanical failures are practically unheard of. For example, in nearly ten years of continuous operation, we have never once had occasion to replace the packing in the rams."

Impressive as it is, this Elmes "case history" is simply typical of the experience of plastics molders the nation over. For details on Elmes Hydraulic Molding Presses see your Elmes Distributor, or write us direct.

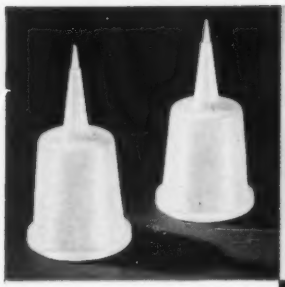
Visit Us at Our Booth No. 1121

ELMES

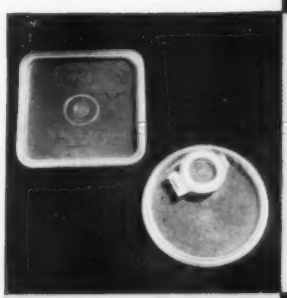
AMERICAN STEEL FOUNDRIES • ELMES ENGINEERING DIVISION
1159 Tennessee Avenue...Cincinnati 29, Ohio

HYDRAULIC PRESSES & EQUIPMENT

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!



Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

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TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

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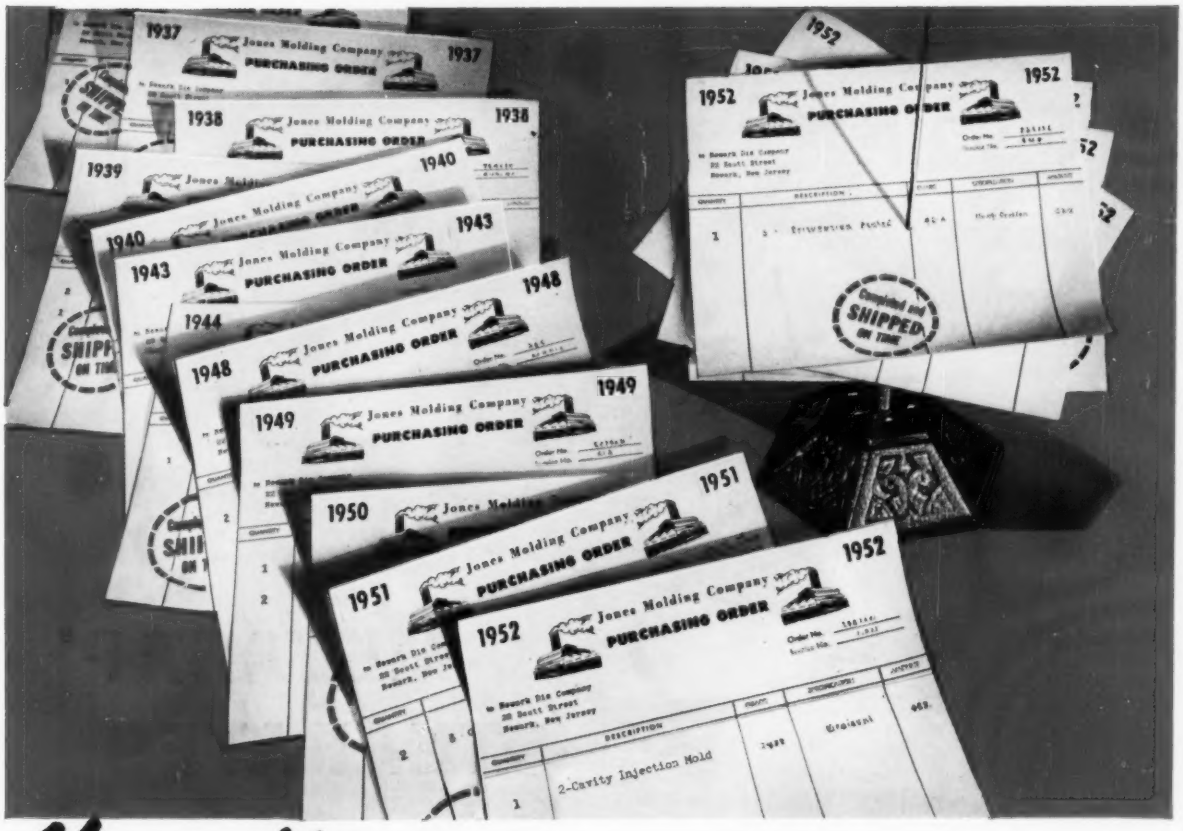

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NEWARK DIE CUSTOMERS* COME BACK

***MORE THAN**
50%
OF THE
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customers of Newark Die have been consistent customers for 15 years or more

When plastic molders *keep* on using the same mold supplier, it's because *they* know they can count on the molds to produce precision parts—and to stand up in service.

The quality of our molds has brought many *new* customers to Newark Die throughout the years. Even more important, we have *retained* the same *old* customers for years.

Our enlarged tool room facilities have enabled us to maintain our high standards of quality and to continuously give good service.

Write for free booklet "SOLVING BIG MOLD PROBLEMS"

NEWARK DIE COMPANY

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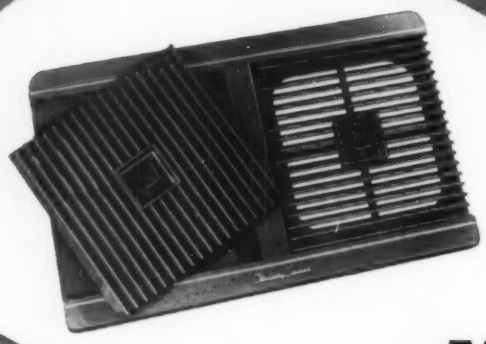
NDCo TRADE MARK

for **TOUGH** molding jobs . . .



METASAP® STEARATES

deliver easier mold release

FOR molding those intricate shapes, for deep drawing, or for larger-than-average pieces, the tested way to easy ejection is to use the right Metasap Stearate in your molding compound.

There are two ways to use these Stearates. Metasap Zinc or Calcium Stearates can be incorporated into the molding compound itself, or simply dusted on the molding surface. Either way, you get improved lubrication at lower ejection pressures. You step up your output, get fewer rejects, and better finished products. Your molds last longer too.

So specify compounds containing Metasap Stearates or incorporate them directly into your own molding compound. Metasap Technical Service is prepared to help you find the materials and mixing procedures best fitted to your production methods.

. . . and to produce economical plastigels

Metasap offers a complete line of quality Stearates, effective as thickening agents. We'll be glad to make available to you free testing samples of Magnesium, Barium, Calcium, or Aluminum Stearates. Ask for yours today.

REG. U. S. PAT. OFF.

METASAP CHEMICAL COMPANY

METASAP CHEMICAL COMPANY, Harrison, N. J.

Chicago • Boston • Cedartown, Ga. • Richmond, Calif.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

The *Answer* to Faster Injection Times...

The 'DOWDING' Patent Heating and Injection Cylinder

The short injection stroke of the Injection Plunger—operating upon homogeneously plasticized material at the nozzle end of the Heating Cylinder—produces a direct displacement of material and does not have to transmit pressure through layers of granular and semi-plasticized material.

The special 'finned' design of Heating Cylinder gives homogeneous plasticizing at high rates and is 'pre-filled' during the molding closing stroke.

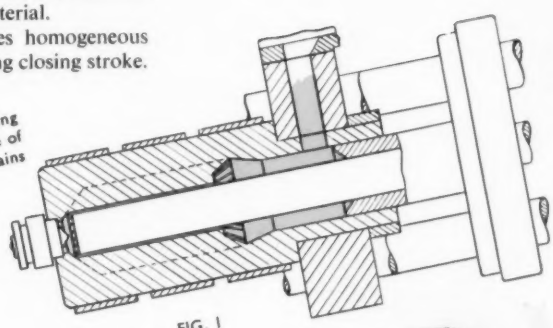


FIG. 1

Fig. 1.—FORWARD POSITION. Here the prefilling ring has drawn back clear of the feed and a fresh charge of material passes into the cylinder; the plunger remains forward.

Fig. 2.—BACK POSITION. After the new charge has been drawn in, the prefilling ring travels forward, compressing the material at the same time as the plunger moves back ready for its forward injection stroke. The nozzle is designed to restrict the escape of material during this action.

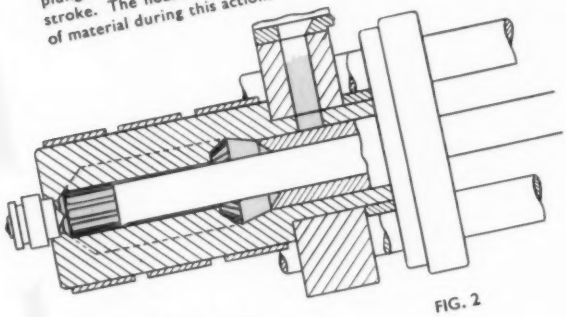


FIG. 2

BRITISH-BUILT

DOWDING

CUTS MOLDING TIMES AND COSTS

SIMPLE TOOLING ENABLES RAPID MARKETING

RAPID DELIVERY

Fully Automatic Fast-Cycling

INJECTION MOLDING MACHINE

Sole Distributors for U.S.A.
Ralph B. Symons Assoc. Inc.
3571 Main Road, Tiverton, R.I.

SPECIFICATION

Approximate weight of material plasticized per hour (Dependent upon weight per shot and material used)... ...	22 lb.
Area of Injection plunger	2.074 sq. in.
Pressure per square inch on material at end of plunger... ...	9,100 lb.
Total pressure on Injection plunger	18,850 lb.
Mold opens (adjustable)	6—9 in.
Maximum die space	7¼ in.
Minimum die space	3¼ in.
Maximum recommended casting area in mold	15 sq. in.
Size of die plates	16 x 10 in.

DOWDING & DOLL LTD
346 KENSINGTON HIGH STREET · LONDON · ENGLAND
Cables: ACCURATOOL HAMMER LONDON

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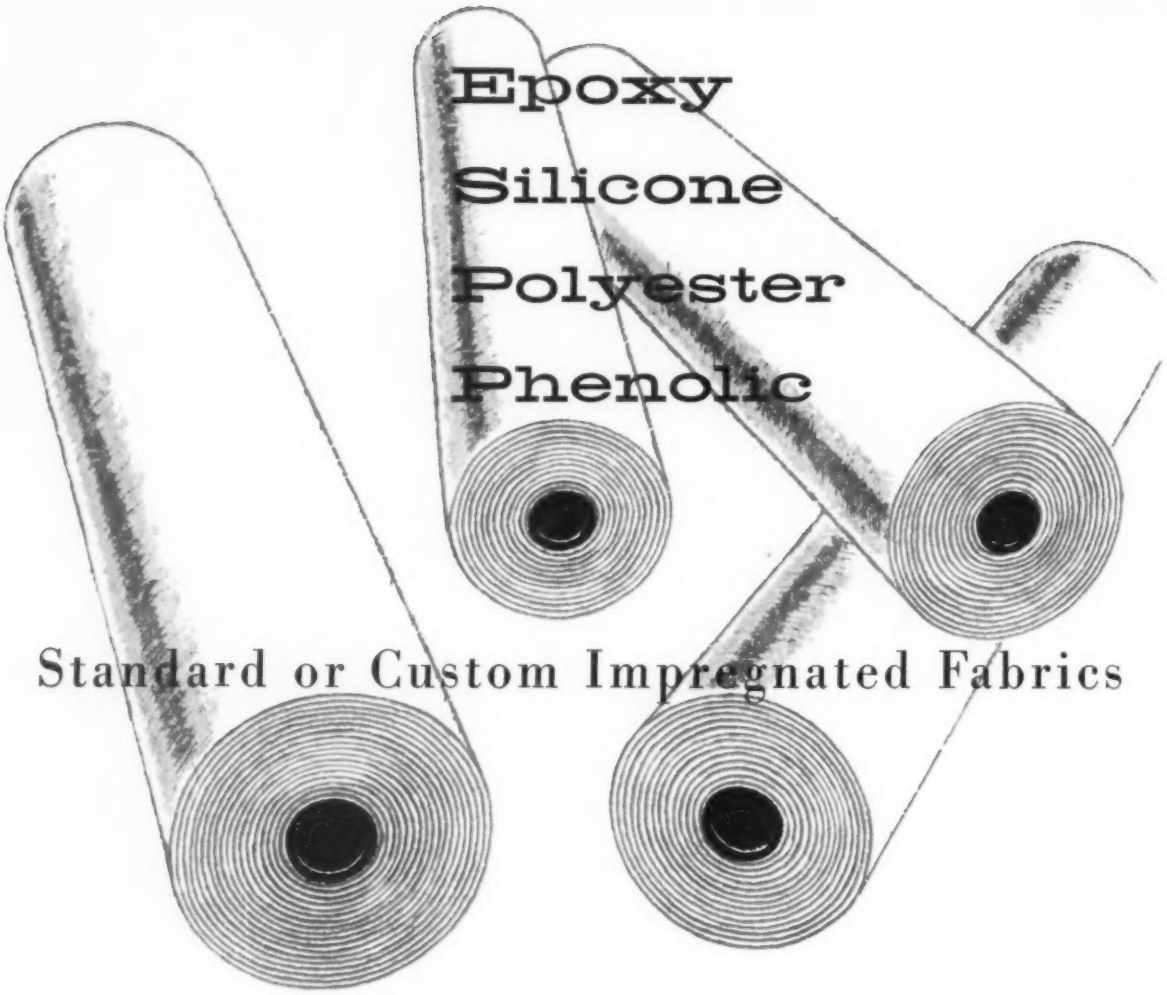
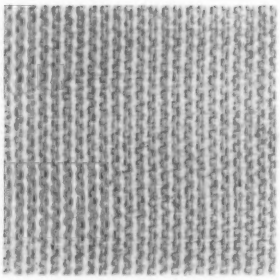


Standard or Custom Impregnated Fabrics



Trevarno
GLASS FABRICS

Write for product specifications and price information.

Whatever resin system you use, there's a preimpregnated Trevarno glass fabric to help you get high quality laminates at low cost. Trevarno fabrics are woven, finished and impregnated under our unique "one-company" operation. They are consistently uniform. This uniformity is vital. It lets you standardize your processing operations, speeds your production. Standard impregnated fabrics are available at low cost to meet volume requirements. Custom impregnations will be developed to meet your exact specifications. Write for product data bulletin on the system you need. Or request help on development of custom products. Remember, quality is paramount at Trevarno.

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Poly-Eth News from the Southwest

Reported by

DEAN BOLDT

Spencer Poly-Eth
Sales Representative

Sam Silberkraus
Los Angeles

Dick Bishop
Chicago

Pete Dornik
Chicago

Carl Virgin
Ohio

Some mighty interesting new applications for polyethylene have been popping up in this area...for example, an extruder in Texas is planning to make 10" and 12" polyethylene irrigation pipe...Another extruder is producing a thick-wall 2" pipe for transmission of natural gas...A large Texas injection molder has designed a new giant wastebasket molded entirely from polyethylene... This same company is already making molded polyethylene shots up to 4 lbs.

A Nebraska extruder has developed a means of extruding natural color polyethylene pipe and laminating a 20/1000 of an inch overlay of black polyethylene for protection against sunlight...A company in Colorado is fabricating a 15-gal. polyethylene drum liner to be used as an insert in a steel drum for transporting and storing various types of corrosive chemicals. Big advantages of this type container are the ease of storing one on top of another, and reduction in breakage.

More and more processors are trying our Poly-Eth Polethylene in a variety of applications. Excellent results have been reported, and we've received compliments on our Tech Service.

SPENCER CHEMICAL COMPANY

GENERAL OFFICES: Dwight Building, Kansas City 5, Missouri

DISTRICT OFFICES: Dwight Building, Kansas City, Missouri, BAltimore 6600;
500 Fifth Avenue, New York, New York, LAckawana 4-7762;
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WEST COAST SALES AGENT: Riverdale Plastics and Chemical Company, 8510 Warner Drive, Culver City, California, TExas 0-1000

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Look for our new series of national ads promoting polyethylene uses.

Poly-Eth *by* **SPENCER**

SPENCER

Robbins new 1¼" extruder for test work ...one compact unit

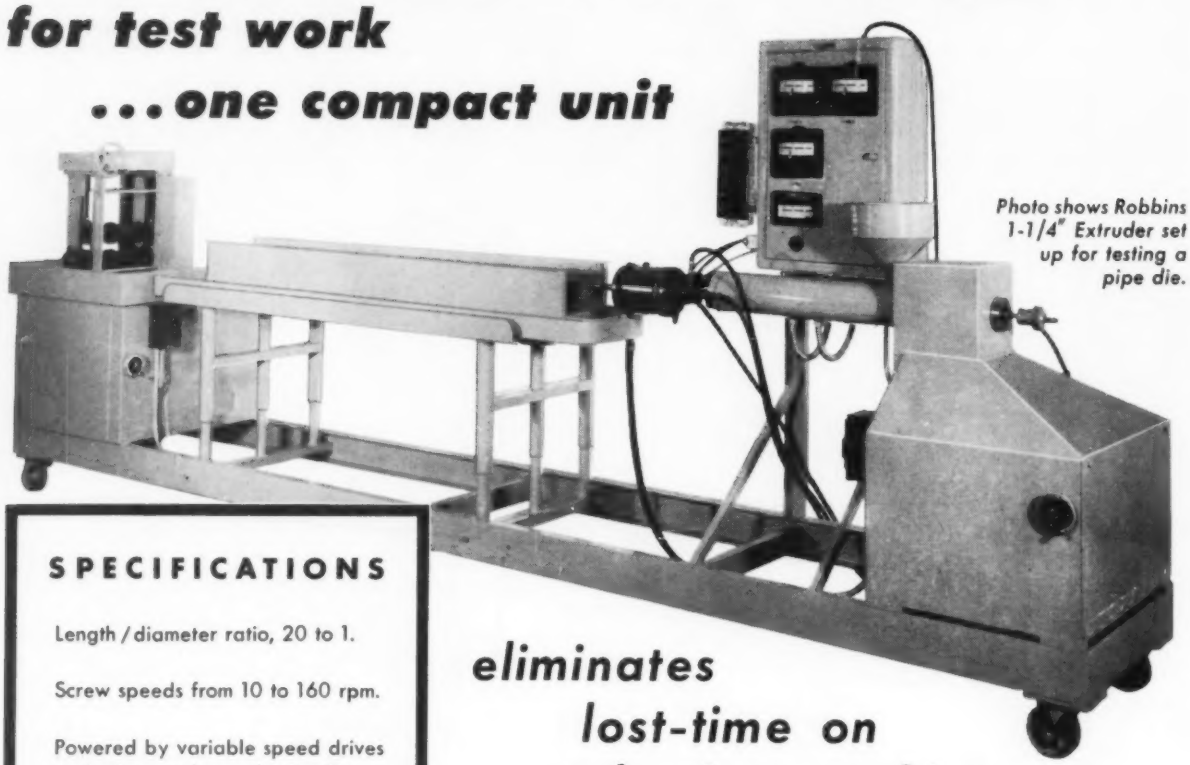

Photo shows Robbins 1-1/4" Extruder set up for testing a pipe die.

SPECIFICATIONS

Length / diameter ratio, 20 to 1.

Screw speeds from 10 to 160 rpm.

Powered by variable speed drives on both extruder and takeoff.

Uses either 220 or 440 volt current.

Xaloy lined extruder barrel.

Screw for any material furnished to specifications.

Water-cooled screw and hopper.

West Gardsman electric control for each zone—2 on barrel, 1 on die.

Water tanks adjustable vertically and horizontally.

All units mounted on strong channel frame. Has 6 swivel casters for ease in handling.

Length of frame 15 ft. 6 in.; width 30 in.

eliminates lost-time on production machines

This new Robbins Test Extruder is available with your choice of take-off equipment built in. Will form small shapes, tubing, pipe, blown film or sheeting. Ideal for testing dies, materials and color before going into production. Any setup of chrome rolls, pull offs, or water tanks can be attached to the common frame with units synchronized. These take-off units are scaled down versions of regular Robbins production machines, and are rigidly constructed for years of hard use.

Write today for full information or quotations on your specific requirements . . . no obligation, of course. Price includes cost of die built to your specifications.

Robbins
never say die . . . say Robbins die

PLASTIC MACHINERY CORP.
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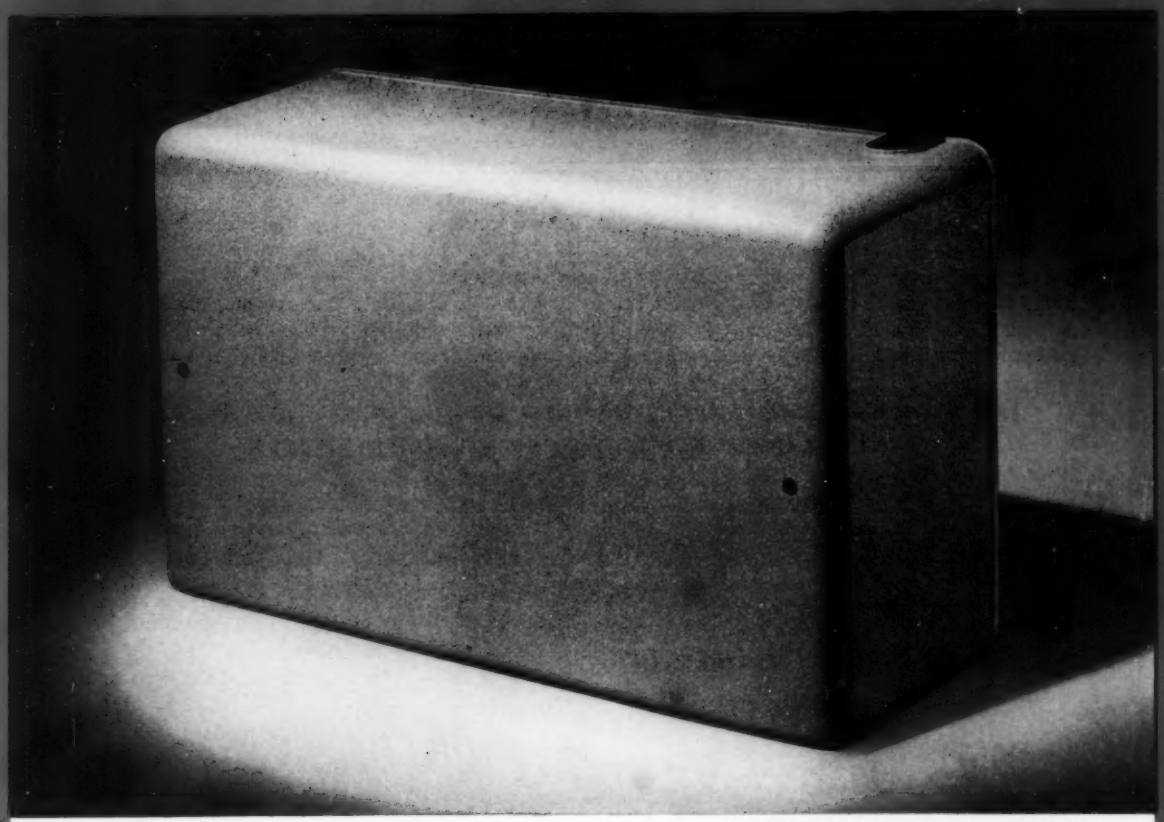

Manufactured by Winner Manufacturing Co., Inc.,
Trenton 3, New Jersey, for Western Electric Co., Inc.

WHY *Winner* MANUFACTURING CO., INC. USES PARAPLEX MOLDING RESINS

Molded of PARAPLEX P-Series resins and glass fiber, this one-piece cover for electrical equipment replaces a three-part assembly of the same dimensions and appearance. The plastic cover, made by Winner Manufacturing Co., Inc., is lighter, requires less assembly time, and has better sound-insulating properties. It's strong, will not dent, and cannot corrode. Winner chose PARAPLEX resins for this job—and for many more—because:

PARAPLEX "P" resins are available in a number of grades, each compatible with all the others. They can be blended to obtain special properties. The resins can be infinitely diluted with monomeric styrene and other monomers.

PARAPLEX "P" resins are 100-percent reactive. They can be converted into solid, infusible products which are soft and flexible, or rigid and tough.

PARAPLEX "P" resins can be cured at either room or elevated temperatures. By proper catalyst selection, they can be adapted to a variety of production schedules. The resins have excellent stability uncatalyzed; long working life when catalyzed.

Whether you're making instrument housings, luggage, translucent structural panels, automobile bodies, decorative laminates, or any one of an almost infinite variety of products—whether you're using matched metal die molding, casting, potting, or low-pressure laminating, easily-handled and fast-curing PARAPLEX P-Series resins may provide the properties you want.

Why not look into these resins? Write Department WW2-5 for full information.

PARAPLEX is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

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TITANOX® white pigments. For all types of rubber and plastics.

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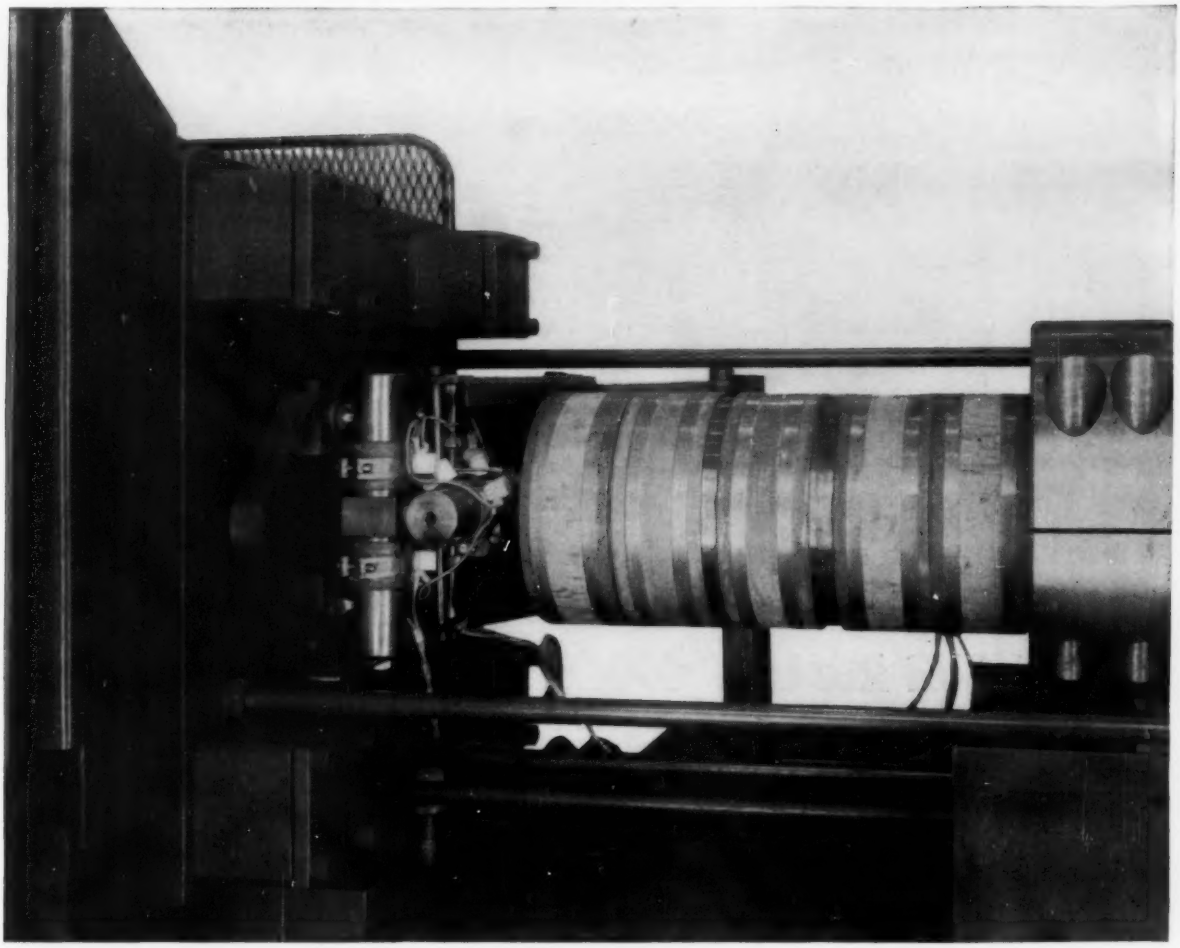

Now Molding – 1200 Parts Per Hour

No Runners
No Sprues
with
FOUR EXTERNAL HOT RUNNER NOZZLES
Developed by IMPCO

For every pound of powder going into the mold, a pound of molded parts comes out! No material to reclaim with subsequent shrinkages and contamination. The multiple nozzle arrangement can be readily disengaged from the die permitting instant clearing in case of plugging from foreign material. There is no insulation problem as only the tips of the four nozzles make contact with the die.

May we offer a demonstration

IMPCO

IMPROVED
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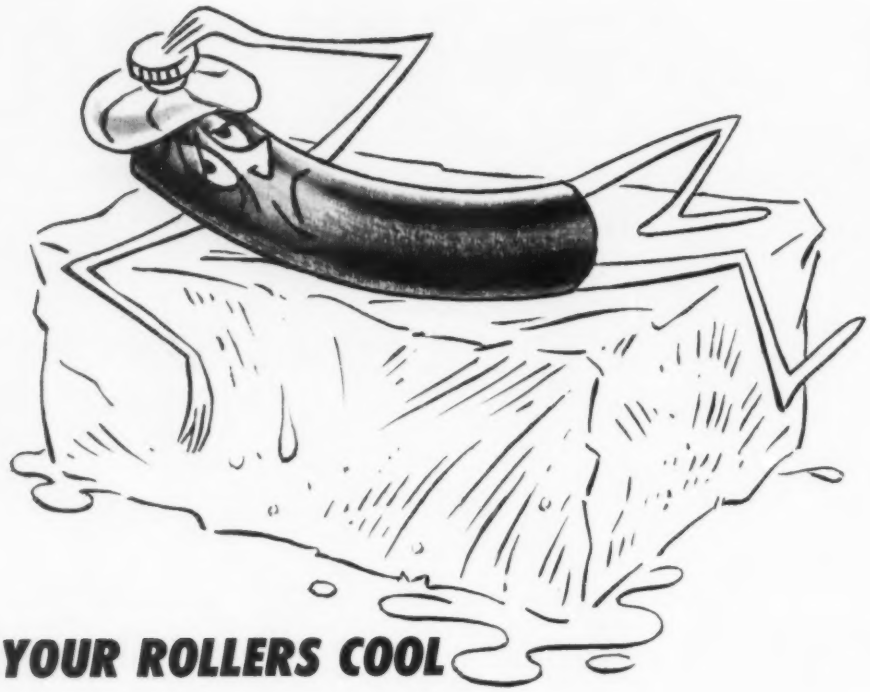

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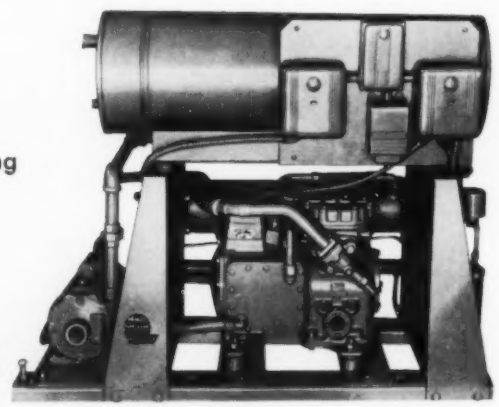
WITH FLOW COLD PACKAGED LIQUID CHILLER

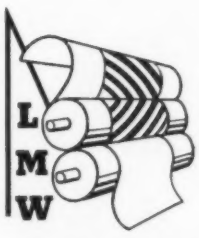
maintains constant coolant temperature summer and winter

- Provides liquid chilling for rollers used in all plastic operations.
- Keeps uniform temperature across roller for quality valley printing.
- Keeps machine at peak efficiency by maintaining exact coolant temperatures.
- Complete packaged unit, ready to install.
- Requires only simple electrical and piping connections.
- Available sizes: 2, 3, 5, 7, 8, 10, 15 to 125 tons.
- Job-proven. Requires little space, can be placed in any convenient location.



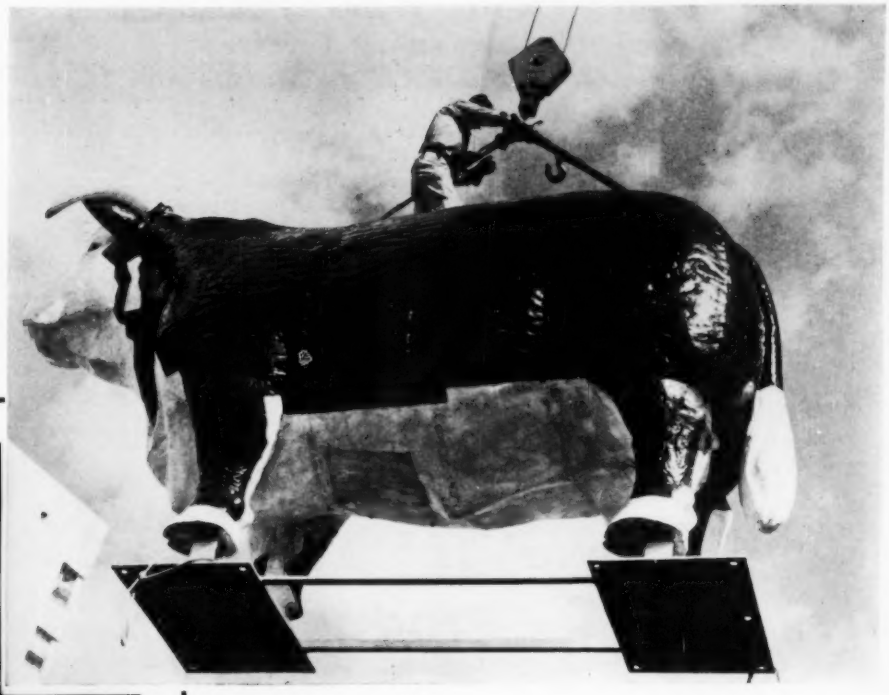
Re-Use your Cooling Water with FLOW COLD all metal Cooling Tower

Eliminates waste of water, saves money. Water is re-circulated and re-used with only about 3% lost through evaporation and necessary overflow. Compact, light, easy to install, economical to operate.



LEMBO MACHINE WORKS, INC., 248 EAST 17th ST., PATERSON 4, N. J. · Mfrs. PRESSES · EMBOSSERS · LAMINATORS · ROLLERS

BIGELOW
Fiber Glass Products



Lew Edwards of Colonial Plastics Corp. holding the original plaster model, and standing between the 12-foot tall bull and its 3-foot prototype.

A little bull goes a long way . . .

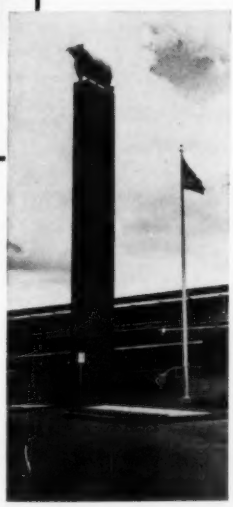
From 6-inch high plaster model to 12-foot tall Bigelow Glass-Mat bull . . . from a plant in North Bergen, New Jersey to the top of a 90-foot pylon in Kansas City, Missouri . . . that's the saga of this pure-bred Hereford bull!

Simultaneous with its appearance atop the American Hereford Association building in Kansas City, this fantastic bull made its debut in a feature article in LIFE magazine, October 25th.

500 square feet of Bigelow Glass Mat went into the making of this fiber glass bull, bag molded by Colonial Plastics Corporation of Newark, New Jersey for Colonial Neon Co., Inc. of North Bergen, New Jersey.

Colonial chose Bigelow 4-ounce FORMAT* for this unusual job because of its outstanding ability to conform readily to intricate curves and details.

* A Bigelow Trademark



BIGELOW FIBER GLASS PRODUCTS CAN SOLVE YOUR PROBLEMS, TOO!

FORMAT* is just one of Bigelow's versatile reinforcing materials. Bigelow has a complete line of products for matched metal die and all types of molding. For further information, fill out this coupon.

Bigelow Fiber Glass Products
Division of
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140 Madison Avenue, New York 16, New York

MIDWEST OFFICE: 243 West Congress St., Detroit 26, Mich.

BIGELOW FIBER GLASS PRODUCTS
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☐ Glass Mats ☐ Woven Roving ☐ Glass Cloth

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Vinyl processors who use fillers often worry about . . .

cost (most of all)
purity
color
processability
plasticizer absorption
uniformity
physical structure

until they try these **Diamond** Products

SURFEX* MM

Precipitated calcium carbonate. Particle size: 1 to 5 microns. Resin coated. Low oil absorption (20-22 cc/100 grams).

Useful as extender in vinyl compounds, lowering compounding costs.

MULTIFEX* MM

Ultra-fine precipitated calcium carbonate. Particle size: .05 to .06 micron. Uncoated.

Used in vinyl compounds for floor tile. Contributes improved abrasion resistance, writing qualities, and higher gloss.

SUPER MULTIFEX*

Particle size extremely fine: .03 micron, very uniform. Coated with two organic surface agents.

Recommended for use when you need maximum tear resistance and tensile strength.

KALITE*

Precipitated calcium carbonate. Particle size about 1 micron. Oil absorption 28-32 cc/100 grams. 1% fatty acid coat.

Used extensively in calendered 20-gauge film such as vinyl upholstery compounds. Excellent calendering properties.

CHLOROWAX* 40

Liquid chlorinated paraffin containing 40% chlorine by weight. Inert, nontoxic, soluble in a wide variety of organic solvents.

Highly suitable as a co-plasticizer in vinyl compounds. Lowers compounding costs.

CHLOROWAX* 70

Resinous chlorinated paraffin containing 70% chlorine by weight. Cream-colored, nontoxic resin. Soluble in most organic solvents.

Useful as processing aid when compounded with rigid and semirigid plastics.

Your nearby DIAMOND representative can show you money-saving formulas and detailed cost comparisons. Or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

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DIAMOND DISTRIBUTORS: C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield (Canada), Ltd.

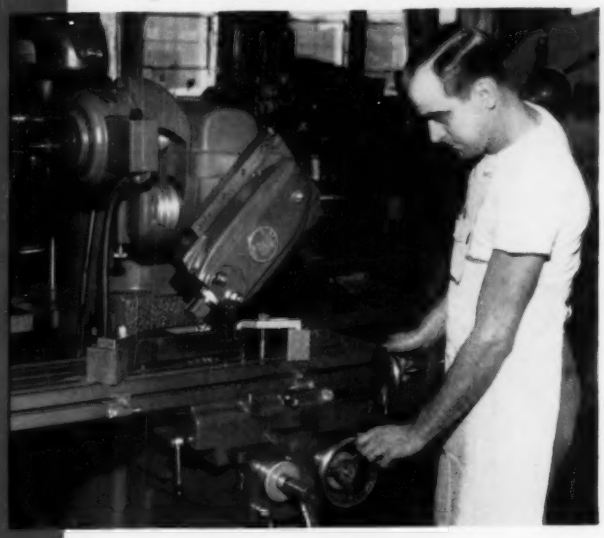
*®

DIAMOND CHEMICALS

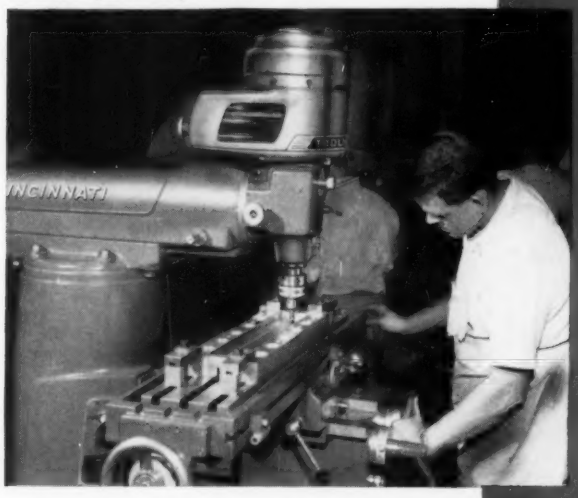
Diamond Chemicals

Toast of the shop

The Shaping Attachment adds shaping operations to the variety of work which may be assigned to Toolmaster Milling Machines.



With two hands on the controls, the Toolmaster operator can smoothly and accurately mill single and multiple cavity molds.



Everyone has something favorable to say about CINCINNATI Toolmaster Milling Machines:

"Ruggedly constructed, take heavy cuts."

"Convenient to operate."

"A real milling machine."

"We did all the shaping operations required for this expensive die."

These are actual remarks by diemakers, foremen and management. And there's a good reason: the Toolmaster design is based upon an extensive survey among tool and die shops. Toolmasters are built to your requirements for light manually operated milling machines. ¶A new CINCINNATI Toolmaster will be a profitable investment for your mold and die shop. May we supply you with more information? Ask for a copy of the latest Toolmaster catalog No. M-1870-2.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES
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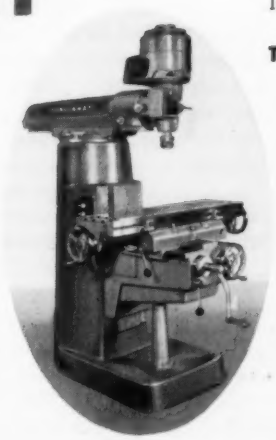
CINCINNATI



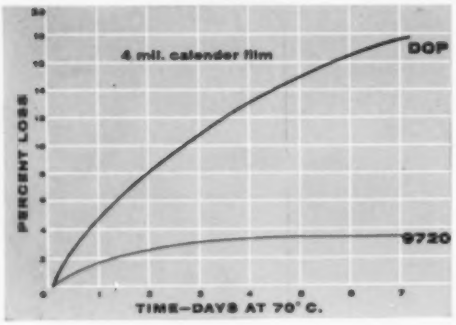
The CINCINNATI Toolmaster is available in three styles:

1A—Manual feed to quill
1B—Power feed to quill (illustrated)
1C—Heavy duty spindle head

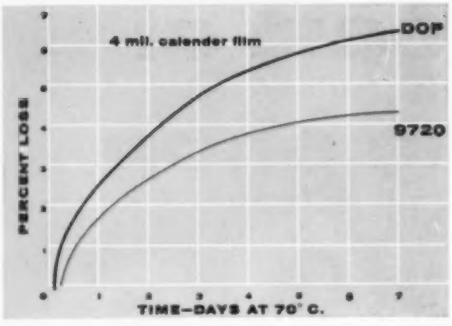
Complete specifications in catalog No. M-1870-2. Write for your copy.

OUTSTANDING

VOLATILITY

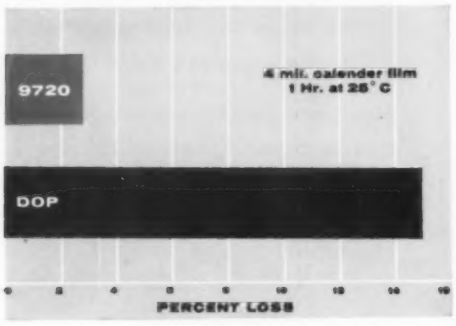


MINERAL OIL EXTRACTION

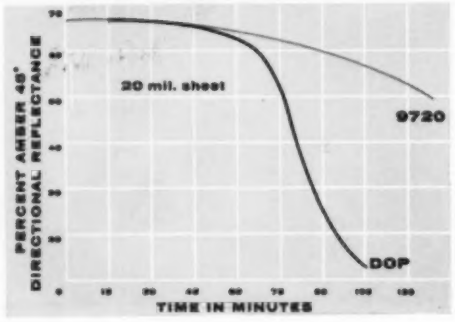


PERMANENCE

GASOLINE EXTRACTION



HEAT STABILITY



...from PLASTOLEIN® 9720, the lowest-cost polymeric plasticizer available

In giving unusual permanence to plastics, you will find that Emery Plastolein 9720 will help make a name for your sheeting and coated fabrics. It has proven its superiority by imparting the kind of outstanding durability and weatherability demanded by fabricators of finished plastic products.

Glance at the illustrated charts, and note its extremely low volatility, excellent resistance to mineral oil and gasoline extraction, superior heat stability. Equally important, Plastolein 9720 is the lowest cost polymeric type plasticizer available.

Furthermore, its lower-than-usual viscosity facilitates handling and permits bulk handling of tank car quantities.

Write today to Dept. F-8 for the complete description of all Plastolein Plasticizers.

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MODERN PLASTICS
VOLUME 32 NUMBER 12 AUGUST 1955

The NEWS About the Nylons

Courtesy Ingwersen Mfg. Co., Inc.

JUST as an only child with a high I.Q. and great talent can be more of a problem to its parents, its teachers, and the public than a dozen average brats, so nylon molding material has historically been a problem to its parents (Du Pont), its teachers (the molders and designers), and the end-using industries.

Possessed of low specific gravity, great strength, high abrasion resistance, toughness, and chemical resistance, nylon has always been one of the most critical materials to mold; it is tempermental towards both moisture and temperature, requiring for proper utilization engineers and designers who know their tolerances, because nylon has erratic shrinkage characteristics.

What do people do to bring a precocious junior genius into line? They put him in a special class with others just as brilliant, and they give him especially patient tutoring. These things are exactly what have been done to nylon.

First, the past few months have seen the development of a whole group of nylons, with several material makers, here and abroad, concerned. Second, design and mold engineering have been directed toward use of the inherent resiliency of all nylons, which in most cases makes precise tolerances unnecessary. This latter, the "tutoring," has been difficult to accomplish because, more than any other plastic, nylon (needing little or no lubricant) competes with metals—and metals engineering is invariably based on fine tolerances and the use of lubricants.

The chart on p. 86 shows the present range of nylons in the class of '55, and shows their relationships in chemical source and properties. Of necessity, the old and new Du Pont designations are emphasized, because for so many years only Du Pont nylons (now Zytel) were available, and both the plastics industries and end users are likely to use them as a basis of reference and comparison.

Who Makes What?

Which companies are making what kind of moldable and extrudable nylons and for what purposes?

Du Pont makes hex-adipic, called

Nylon Engineering in a Linotype Machine

Courtesy E. I. du Pont de Nemours & Co., Inc.

Molded nylon electrical fittings used by Navy to save weight. See text, p. 89

Zytel 101, to date the work-horse nylon; a weather-resistant version, Zytel 105, containing carbon black, finely dispersed; hex-sebacic, called Zytel 31 and 33, softer, with lower water absorption and a lower melting point; probable copolymers, designated Zytels 63 and 69, which are soluble in alcohols and can be used in dispersion for textile treatment; a hybrid, Zytel 3606, made only for infantry wire coating, chemical nature a secret; and, finally, a polycaprolactam, Zytel 211.

Barrett Div., Allied Chemical and Dye Corp. makes polycaprolactam-type nylon, Plaskon Nylon. It comes in two versions: 8200, a stiff form for molding and 8201, a more flexible variation for extrusion, film making, and bottle manufacture.

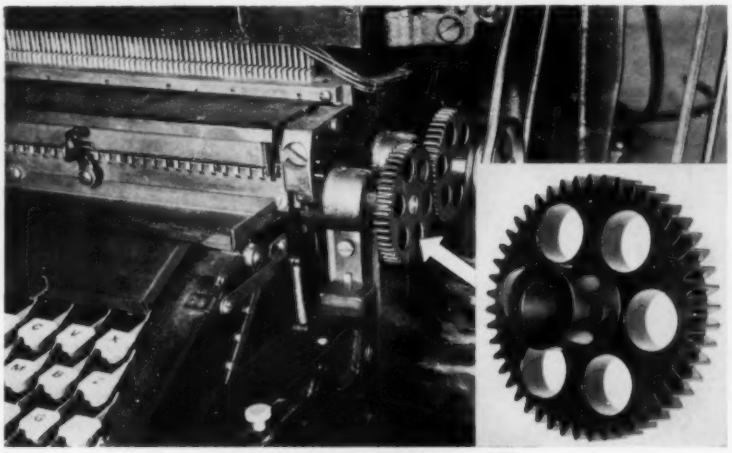
Chief differences presently being promoted between the European-born caprolactams and the American-type nylons are: the controllable crystalline structure of the former, permitting orientation; and a relatively high molten viscosity, declared to make them less critical to mold and extrude.

American Enka Corp. produces polycaprolactam-type nylon under the tradename Nylenka. Enka's parent organization, Algemene Kunstzijde Unie in Holland sells Akulon, another polycaprolactam, in the United States through a representative, K. Blaak, Ashville, N. C. Akulon is produced in the following grades: K2, a low-viscosity material for molding; M2, a medium-viscosity nylon for extrusion; B2,

The Nylons—Sources, Trade Names, Properties

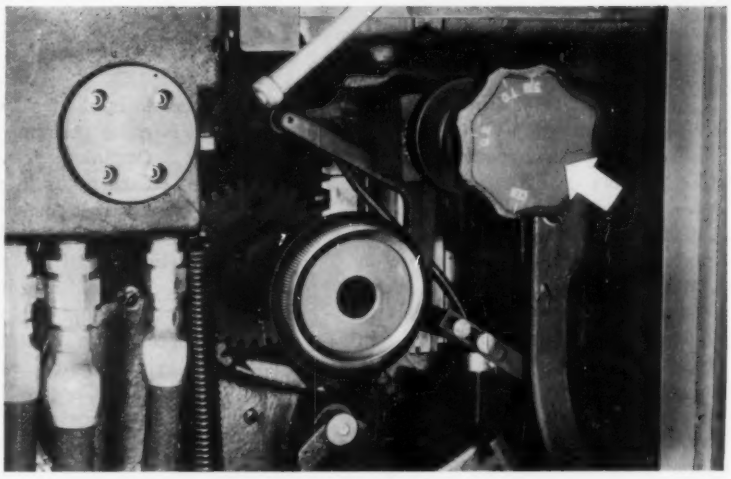
Chemical basis of nylon	Chemists' designation	Old Du Pont type No.	Suppliers and trade names	Comments on properties and applications
Hexamethylene-diamine-adipic acid	nylon-6/6	nylon type 10	E. I. du Pont de Nemours and Co., Inc. —Zytel 101 and 105	General-purpose material, Zytel 101. Zytel 105 is same with carbon black added for weather resistance.
Hexamethylene-diamine-sebacic acid	nylon-6/10	nylon type 3	E. I. du Pont de Nemours and Co., Inc. —Zytel 31 and 33	More moisture resistant than the above, more flexible, easier to work, less heat resistant, and less stiff. Zytel 33 is heat-stabilized Zytel 31.
Alkoxy-substituted nylon, hexamethylene-adipic acid		nylon type 8	Belding-Corticelli Industries—B.C.I. Nylon	For fiber bonding and treating, extrusion, and solution-coating. By heat and/or acid can be cross-linked and made thermoset. Soluble when thermoplastic.
Not disclosed, possibly a copolymer		nylon type 6	E. I. du Pont de Nemours and Co., Inc. —Zytel 63 and 69	Soluble in methanol and ethanol, but cannot be made insoluble. Used chiefly for textile treating.
Not disclosed, made specifically for the army			E. I. du Pont de Nemours and Co., Inc. —Zytel 3606	Made only to army specifications for infantry wire jacket.
Polycaprolactam	nylon-6		Barrett Div., Allied Chemical and Dye Corp.—Plaskon Nylon 8200 and 8201 E. I. du Pont de Nemours and Co., Inc. —Zytel 211 Alfred C. Toepfer, Inc.—Grilon American Enka Corp.—Nylenka Algemene Kunstzijde Unie—Akulon	Controllable crystalline structure, permitting orientation for film. Fairly high molten viscosity.
Polymer based on castor oil derivative, 11-amino undecanoic acid	nylon-11		Rilsan Corp.—Rilsan	Easily plasticized. Low specific gravity. Fairly low melt point but high decomposition point. Very fluid. May be graphited for friction applications. High moisture resistance.

Nylon Engineering in a Linotype Machine

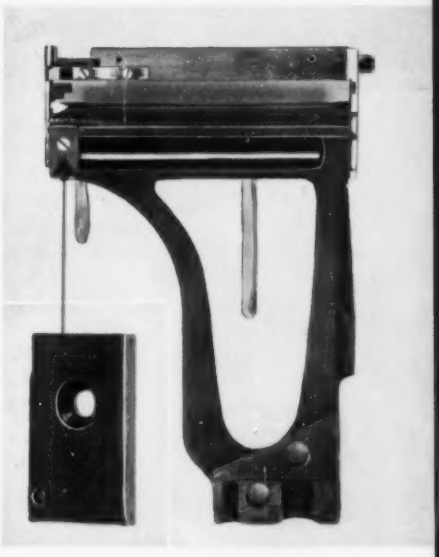


GEARS FOR RUBBER KEYBOARD ROLLS

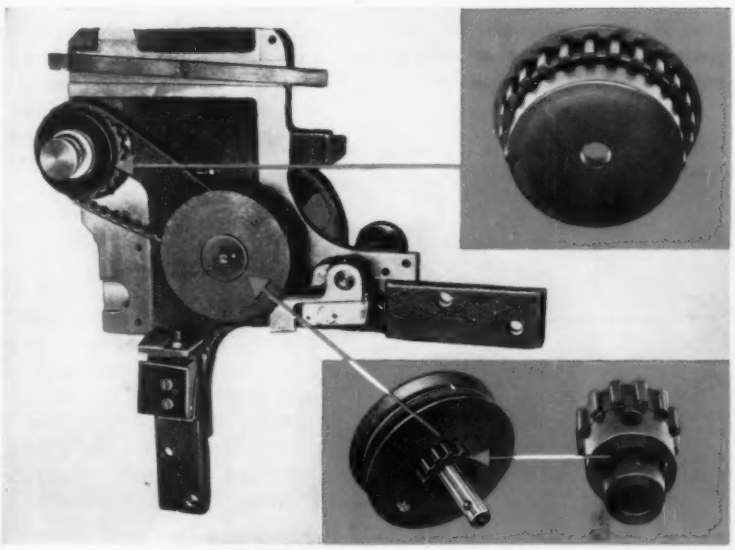
ASSEMBLER STAR



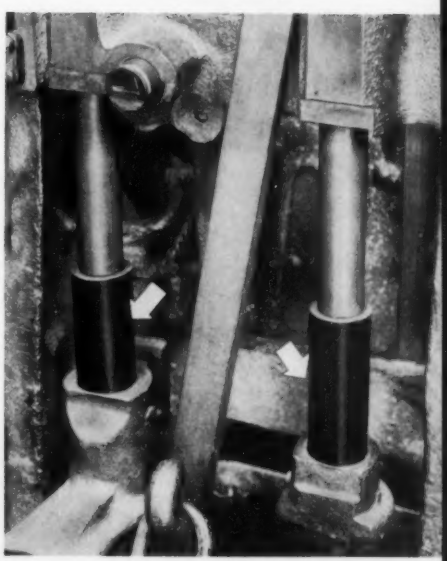
SELECTOR HANDLE CONTROL KNOB



MATRIX BUFFER



ASSEMBLER PULLEY AND STAR SPROCKETS

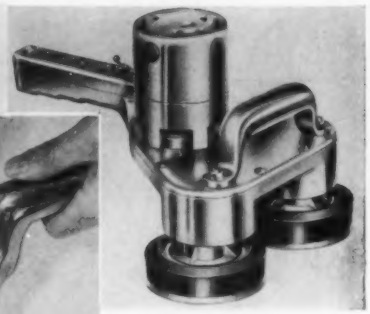


STOP SLEEVES

Photos courtesy Mergenthaler Linotype Co.

Specialized nylon parts are used in the complicated and fast running linotype machine at points where abrasion resistance, impact strength, and resiliency are important. Details are described on p. 89

Polishing machine (right) has nylon gears (below, right) produced in electroformed molds (below, left). Objectives: quiet operation, no lubrication, minimum maintenance



Courtesy Ingwersen Mfg. Co., Inc.

an extrusion-grade high-viscosity material; M10, medium-viscosity material for both molding and extrusion; and M2A, a light-and-heat-stabilized molding material.

Grilon, another polycaprolactam, is made by Holzverzuckerungs A. G., in Switzerland, and imported by Alfred C. Toepfer, Inc. Six types of Grilon are offered: A22, a low-viscosity material for thin section work; A22S, the same but light-and-heat stabilized; A25, a general-purpose material made in many colors, A25G, the same, with lubricant added; A30, a form especially stabilized for extrusion; D20, light-stabilized nylon and plasticized with a water soluble plasticizer for cable coating.

Belding-Corticelli Industries recently purchased a license from Du Pont to make and sell an alkoxy-substituted hex-adipic nylon formerly known as nylon-8. Du Pont will no longer produce this material. BCI Nylon is unique in that it is cross-linkable by heat or acid and may, therefore, be either thermoplastic or thermoset in nature. In thermoplastic form it is soluble in alcohols, and dispersable, so may, therefore, be used as a coating, a textile bonding resin, or a fiber extrusion material.

Through alteration of the alkoxy substitution, physical characteristics of the thermoplastic version may be changed, so that a range of materials from "breathable" film for shoe uppers to laminates for the luggage field is quite possible.

From the Organico Co. in France comes Rilsan nylon, a polyamide derived from castor oil, classified as nylon-11. It is sold in this country by Rilsan Corp. in various forms for molding, extrusion, and surface coating.

Finally, there is a specialized polyamide or nylon-type resin made from soybeans by General Mills Inc. Alloyed with epoxy resins it is useful as a superior adhesive and as a coating material.

Basically, then, there are five main types of nylon: 6/6, hex-adipic; 6/10, hex-sebacic; 6, polycaprolactam; 8, the alkoxy type; and 11, the castor oil-derived polyamide—plus the two Du Pont materials of undisclosed nature. The differences, in terms of molding characteristics and properties for application consideration, will be found in the makers' and distributors' literature.

Some are harder than others, some have higher viscosity than others, some are declared to accept additives such as colorants, fillers, and lubricants more easily than others. The whole range of nylon gives molders, extruders, and surface coaters great versatility in serving specialized markets.

Courtesy Chicago Molded Products Corp.

Molded nylon, specified in original design for thermostat control pinion in automatic-heat electric frying pan handle, proved it can do a tough job in simple fashion

Key to Markets

That expression "specialized markets" is the key to applications of the nylons. They are engineering materials to be used only where

they can do a job better than other materials. This is why nylon bearings, gears, grommets, and fasteners are rapidly becoming standard in many fields where such parts are used. In bearings, nylon generally requires no lubrication so it can be kept clean. But bearings must be designed to permit shrinkage and expansion with changing conditions of humidity and temperature. In gears also, lubrication usually is not necessary, and resistance to wear gives long life. But gears must be designed for nylon, with looser tolerances than those used for metal or other gears. In grommets and fasteners, nylon has "give" to take up pressure. For the same reason, nylon rates high in strain relief bushings.

Navy Use

One of the biggest volume jobs in molded nylon is a series of electrical fittings which have made it possible for the United States Navy to reduce the weight of an aircraft carrier by some 30 to 45 tons. These fittings—"stuffing tubes"—are used to form watertight seals where an electrical cable enters a fixture or a terminal box. In nylon they weigh 80% less than the former metallic tubes and save 50% in initial cost and labor. Molded by Danielson Mfg. Co., Danielson, Conn., the stuffing tubes are made up of three pieces of threaded molded nylon fittings with neoprene grommets to grip the cables. Instead of being welded in place, as was the case with metal stuffing tubes, the nylon fitting is tightened down on a neoprene O-ring to form a watertight seal. Variations in grommet size make it possible for nine standard nylon stuffing tubes to do the job which formerly required 27 sizes of metal fittings. The nylon can take the punishment of installation, resists the corrosive effects of salt water and galvanic action, and does not need to be painted.

In Linotype Machine

An excellent example of good engineering use of molded nylon is in the enormously complicated Mergenthaler Linotype machine whose thousands of parts are constantly in motion and subject to wear. (See photos, p. 87.)

In an accompanying group of illustrations, applications of nylon molding engineering to various parts in the Linotype machine are shown. Nylon gears for rubber keyboard rolls proved superior to cast iron gears from the standpoints of both price and function. They are noiseless, require no lubrication, and will show no wear in years of use. The selector handle control knob of nylon also replaces a cast iron part, the reasons being reduction of weight and inertia, provision of better appearance and "feel," elimination of the extra operation of stamping lettered information on the face, and provision of longer wear life for detent holes.

An assembler starwheel used on the Linotype machine to stack brass matrices in the assembling operation is a case where nylon replaces fibre material. The part is subjected to constant rubbing and impact and replacement was formerly a problem. An additional point was former high cost of manufacturing occasioned by the broached square shaft hole; by molding, the cost was cut. The nylon starwheels are made in three colors (red, white, blue) to distinguish the different sizes.

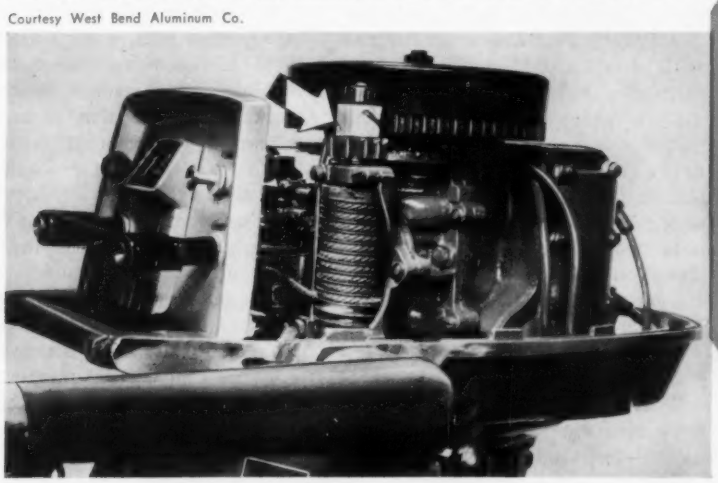
On the assembly unit also are two sprocket wheels used as part of a timing belt drive, which were formerly made from steel. The geometry of these parts, with their

Courtesy The Maytag Co.

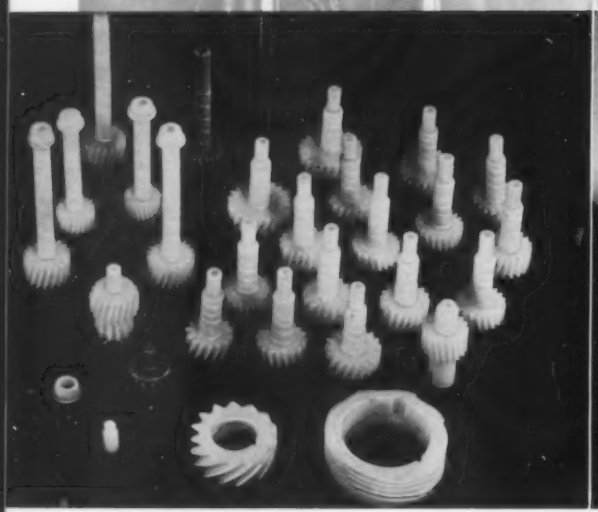
Nylon bearing halves (lower right) replace powdered metal and other metal parts in a washing machine bearing

Outboard motor housing has been removed (below) to show position of wear-resisting molded nylon pinion gear (close-up at right) used in electric starter system

Courtesy West Bend Aluminum Co.



Coin box for buses (left) sorts coins deposited and tabulates the amount, is in almost constant operation while bus is in use. Maintenance and replacement of parts has been reduced almost to the vanishing point by the adoption of dozens of molded nylon parts—gears, star wheels, cams, etc. (photos below)—to replace metal parts



Courtesy Grant Money-Meters Co.

specially shaped teeth, made them expensive in metal. Not only was the cost lowered and the parts simplified in nylon, but the teeth stand up to the wear and load imposed by the action of the toothed belt and the face of the large sprocket stands up to wear in clutch service. Formerly the large sprocket was made in two parts, but redesign has made it possible for the molders, Molding Specialists, Inc., Yonkers, N. Y., to produce it in one piece.

In a matrix buffer for the Linotype assembling elevator, nylon replaces fibre again, offering three times the life, and again molding resulted in lower costs.

Finally, stop sleeves used on a justification mechanism were switched from steel to nylon. These sleeves serve to limit the movement of two slide rods; because of the forces and velocities involved, they are subjected to heavy impact. The parts redesigned as nylon moldings greatly reduced noise while the impact strength and cushioning resiliency of nylon made it ideal for the job. A plus value was discovered in the redesigning of these parts for nylon molding. It was possible to obtain closer dimensional control of the inside diameter and to eliminate two saw cuts and a crimping operation necessary with the steel sleeves to keep them from "sloping" and cocking.

Engineering Pattern

Wear resistance, impact strength, noise reduction, obviation of lubrication—the engineering pattern of nylon application is clear. In addition, there is the very important point of coloring nylon. Most of the makers of the various nylon materials will provide molding powder or granules with color added. And it is earnestly recommended that molders do not tamper with nylon molding or extrusion material by attempting to color it themselves. Some plastics materials compounders such as Gering Products, Inc.; H. Muehlstein and Co., Inc.; Plastics Materials Corp.; and Polymer Corp. of Pennsylvania, feature specially compounded and colored nylon materials. But it is a fairly simple and practical matter to dye nylon parts after molding by dip method in an aqueous system. Several of the parts in the above-described Mergenthaler Linotype machine were dip-

dyed. Extruded nylon rod and tubular stock for fabricating is available from most of the aforementioned processors, plus Nytef Plastics, Inc.

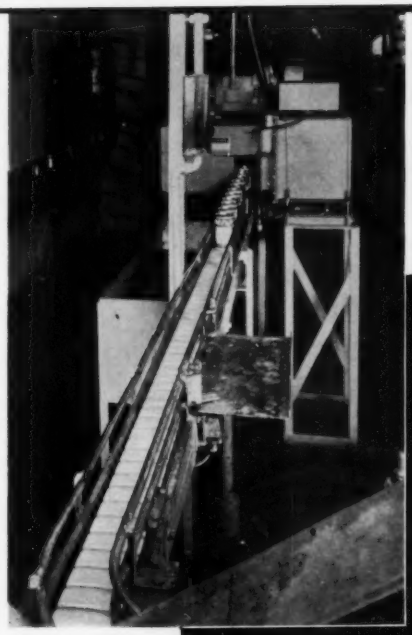
Electroformed Molds

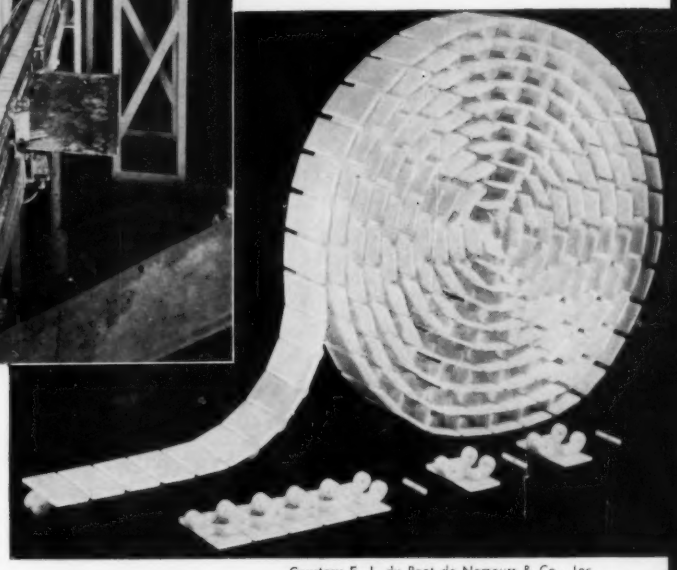
A recent application of nylon which is especially noteworthy because it was done in electroformed molds, is the gear train molded for Cyclo Mfg. Co., Denver, Colo., by Ingwersen Mfg. Co., Inc. of the same city. The train is used in a lightweight, two-head polishing machine and the reason for using nylon was to do away with lubrication, to achieve quietness, and gain freedom from replacement of parts.

The parts are molded in a three-cavity mold and include two right hand helical drive gears and a left hand helical idler gear, all with metal shaft inserts molded in. The natural molding shrink of the nylon makes the use of this type of insert most practical. The gears were molded to a tolerance of ± 0.0025 in. and the electroformed molds produced by Electromold Corp., Trenton, N. J., have proved more than adequate for the job.

Original Engineering

Not always is nylon called upon to replace steel or some other material. There is a trend toward product design involving original use of nylon with proper engineering. An example is the thermostat control pinion in the Sunbeam controlled heat automatic frying pan. The pinion, molded by Chicago Molded Products Corp., is a very minute component with a molded-in metal shaft, and is literally the key to the successful operation of the device. The part could not be compared to a similar part made out of anything else because it was





Conveyor belts made up of molded nylon sections (below) are being used in food packing plants and other places where contamination from lubricants and other sources must be avoided and where resistance to corrosion is desirable

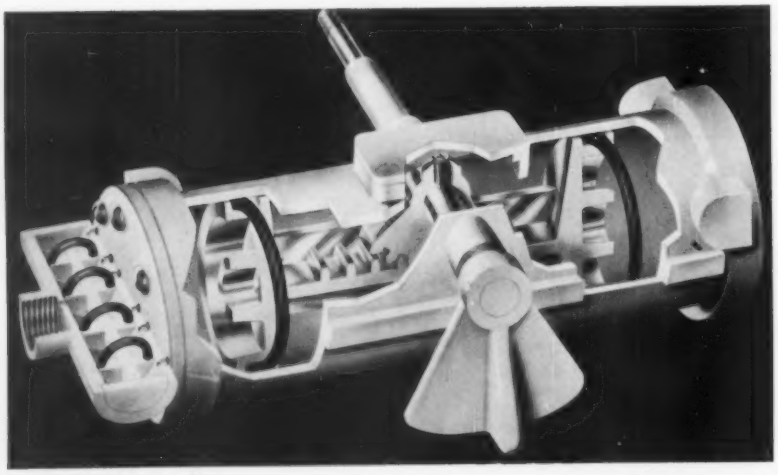
Courtesy E. I. du Pont de Nemours & Co., Inc.

Courtesy Heli-Coil Corp.

Now molded of nylon and carrying a lifetime guarantee, rewinder for wire thread inserts (left, and in use above), was once made of steel and aluminum

Courtesy E. I. du Pont de Nemours & Co., Inc.

Tubeless tire puncture sealer (parts at right and in use above) is molded of nylon. Carbon-black-added formulation was used to reduce light transmission and thus make sure that enclosed sealant will not deteriorate during storage because of ultra-violet light



Courtesy Sprague Devices, Inc.

All-nylon windshield wiper motor has a number of design features which illustrate the possibilities of applying molded nylon parts in the fields of liquid and air pumping

never made before. In use it has proved most satisfactory.

From the same molder comes a quite spectacular job of metal replacement by nylon. This is a case where a single half bearing molded of nylon is used to replace four ponderous metal parts in the wringer assembly of a washing machine produced by The Maytag Co., Newton, Iowa. The parts replaced are a spring, a spacer, a clip, and a body.

The body was formerly a powdered metal bearing which had to be treated in an oil bath. The switch to nylon has increased the life of the bearing over five times, has saved a great deal of money by elimination of two parts, and has cut assembly costs of fastening the bearing parts in the machine.

Comment from the engineers concerned with this redesign is to the effect that no particular problems were involved—they merely forgot about metal and reoriented their thinking to nylon.

A job for which both nylon and steel were considered but which was won by nylon and is molded by Chicago Molded Products is the nylon pinion gear for the starting mechanism of the Elgin outboard motor made by West Bend Aluminum Co., Hartford, Wis. It costs less than steel, it weighs less, it is much more quiet, and since it has to wear against an aluminum ring it proved more wear-resistant than steel.

The nylon-engineering approach to product design is well exemplified in the Electrofarer made by Grant Money-Meters Co., Providence, R. I., for which parts were molded by Danielson Mfg. Co. The old, old problems of back-lash, inertia, lubrication, and wear in fast moving industrial machine components were those faced by the designers. While a bus is on its route the money-meter, which sorts the coins and tabulates the amount deposited, is in almost constant operation. Maintenance and repair on such devices is a headache to all concerned, so the purpose was the elimination of this factor.

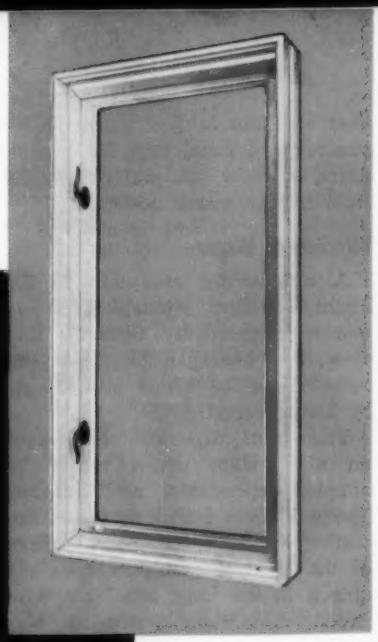
The machine was originally designed with steel parts but when design for nylon was completed, dozens of parts had been translated into the plastic. The long-term cost of the machine in operation was reduced by the use of nylon com-

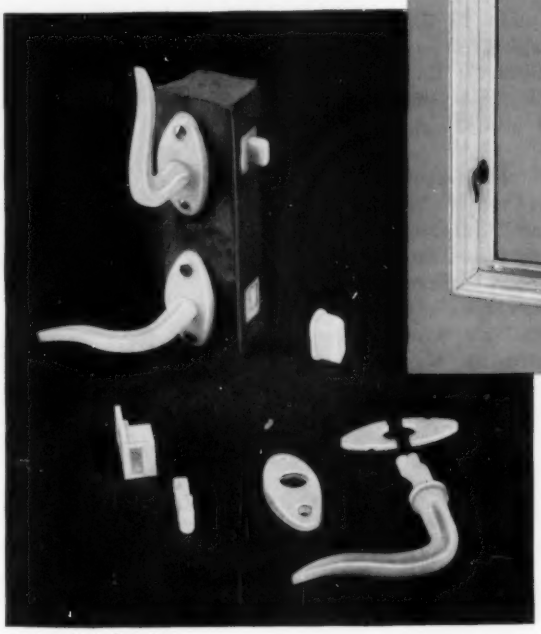
ponents, since maintenance and replacement were cut virtually to nil, and customer satisfaction was tops.

An entirely different problem involving a different approach was involved in the creation of a tubeless tire puncture sealing device for Firestone Tire and Rubber Co., developed by Jim Robbins Co., Royal Oak, Mich. Zytel 105, the carbon black-added variation of 101, was used to reduce light transmission through the product and thus insure that the puncture sealant would not deteriorate from attack by ultraviolet light, even if it were in storage for several years. The nylon also offered resistance to the solvent action from the liquid rubber emulsion.

Even in such a simple device as this, the engineering aspects are pointed up. There were two internal and two external threads, yet all of the pieces were made in one family mold. The pitch of the thread is different on the barrel section of the cap than it is on the smaller plunger section, so these pieces had to be spun off a fraction of a minute apart to achieve balanced production. The barrel itself has a flash molded over the large end as a seal and this remains in place until the "gun" is placed in use, at which time the force of the screw plunger shears the thin 0.005-in. wall section of the seal, allowing it to become part of the screw plunger action.

Building hardware field opens to molded nylon through window lock (right). Demonstration lock setup and molded parts are below



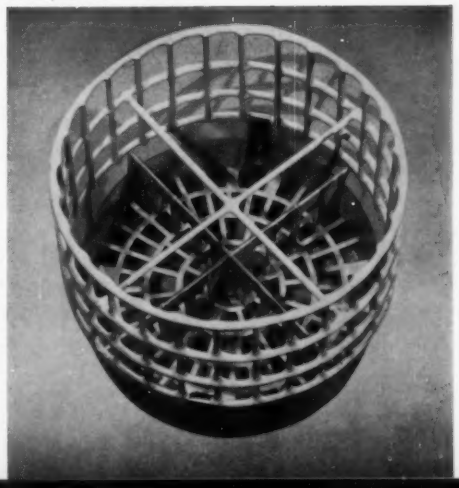


Courtesy Curtis Cos., Inc.

Courtesy South Bend Bait Co.

Spinning reel components have been molded of nylon for some time past; use of the material has now been extended to a locking device for fastening the reel securely to the rod

Courtesy General Electric Co.



In silverware holder for automatic dish washer, molded nylon replaces vinyl-covered wire mesh plus stainless steel component with improved efficiency and lower over-all cost

Conveyor Belts

Continuing problems in all conveyorized plants are corrosion resistance, lubrication, wear, maintenance, and motor power.

Now going into food, beverage, and drug plants are quiet-running conveyor belts and chains in several sizes molded for Fenco, Inc., Chicago, Ill., by Du Bois Plastic Products, Inc., Buffalo, N. Y. Resistant to food acids, alkalies, and brine solutions, the nylon conveyor may be steam-sterilized. It requires no lubricant and uses much less power than metal belts.

When a product designer approaches the matter of materials selection in development of a completely new product from a new idea, he is well advised to think of nylon and of nylon alone rather

than consider a few nylon components in a metal unit. Many products, however, are still redesigned from former metal models.

Windshield Wiper

A noteworthy exception is the Mighty Midget windshield wiper motor produced by Sprague Devices, Inc., Michigan City, Ind., the nylon parts for which are molded by Danielson Mfg. Co.

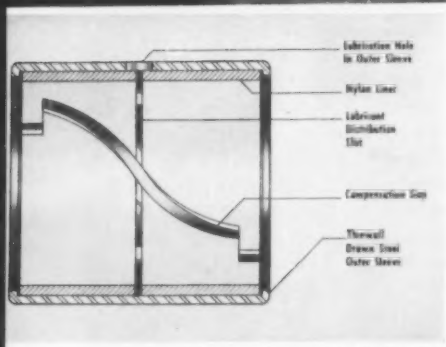
The first step was to design an air system which would be simple, dependable, and durable. The engineers found that zinc die casting would be expensive because of the type of cylinder bores required in the long, small air passages. Aluminum extrusion was next studied and both finishing costs and bore tolerances plus high original tooling cost made the material and the method unfeasible. Combinations of castings and extrusions in several metals were studied. None had all of the required economic qualities.

Nylon could be molded in any shape desired, giving cylinder bores of close tolerance and fine surface finish as-molded, without requiring draft. The lightness of the material was an advantage, and, since an O-ring seal was to be used, the mechanical bearing qualities of nylon and its adequate friction coefficient made it the final choice.

The nylon windshield wiper motor has now been in fairly wide use for over a year and not a single unit has been returned on warranty; neither has there been any occasion, after the three-month warranty had expired, to replace any parts. This compares with the service life of metal windshield

Courtesy E. I. du Pont de Nemours & Co., Inc.

Specially formulated material in a range of colors is being used to produce proprietary hospital utensils that are not affected by autoclaving or cold sterilization

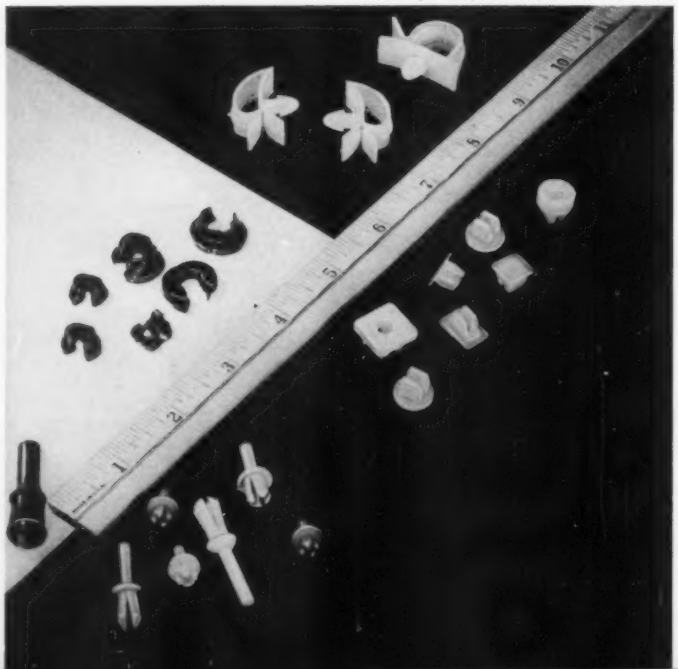


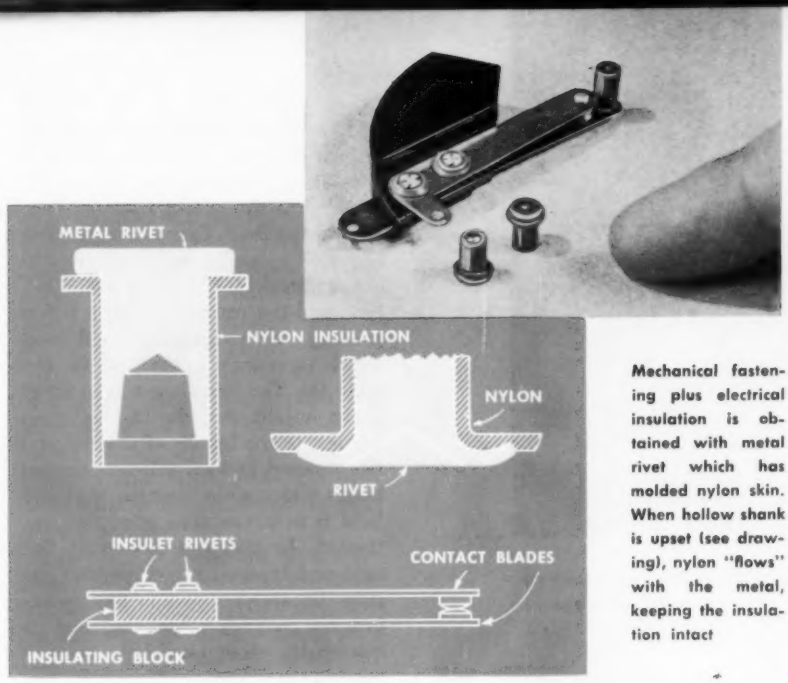
Courtesy Thompson Industries, Inc.

Nylon bearing is a well-engineered molded insert liner for a thin-walled stainless steel tube. It may be used either with or without lubrication

Molded nylon fasteners, grommets, and rivets are finding innumerable uses in the assembly of durable goods. They are made in a wide variety of styles and sizes

Courtesy Shakeproof Div., Illinois Tool Works





Mechanical fastening plus electrical insulation is obtained with metal rivet which has molded nylon skin. When hollow shank is upset (see drawing), nylon "flows" with the metal, keeping the insulation intact

wiper motors in truck fleet use of two or three months. In fact, Sprague is reported to be the only producer of a windshield wiper for commercial use who offers a warranty. Finally, the product is considerably more efficient in operation because of the O-ring seals and the high finish of the cylinder bores.

Another case where the durability of molded nylon has made it possible for a warranty to be issued to the customer is in the Heli-Coil inserting tool made for Heli-Coil Corp., Danbury, Conn., by Molding Specialists, Inc. The tool is a prewinder used for easy installation of Heli-Coil stainless steel wire thread inserts in the assembly of stainless steel food equipment and other products. Originally this unit involved the use of an aluminum sleeve with a prewinder thread in a tool steel tip. It worked well, but not well enough; the nylon inserting tool under comparable conditions will do three to five times as many insert installations as the metal job.

The importance of the tool in aircraft and automotive manufacture, food machinery construction, and repairing of threads damaged during manufacturing or use is obvious. The importance of nylon in the tool which does the winding and inserting is proved by the economics.

Consumer Goods

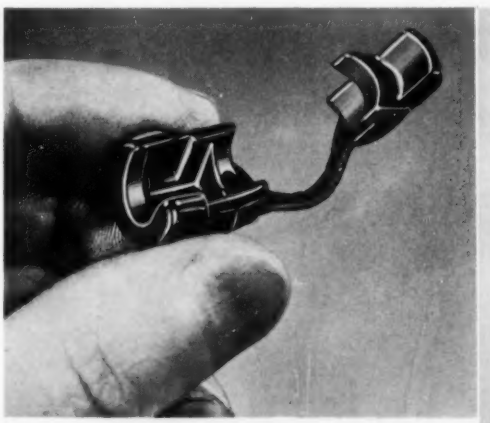
In the field of consumer goods, nylon has long been effectively used in components for refrigerator catches and shelf fasteners, drawer slides in furniture, automobile door locks and dome lights, gears for food mixers, etc. In each case, considerable pioneering was involved and while the techniques of design and molding were learned, considerable expense was also incurred.

A new field for nylon moldings has just been opened up by Curtis Cos., Inc., Clinton, Iowa, in building hardware. It is perhaps not strange that the building hardware people themselves were not receptive to nylon or any other plastic, having centuries of metal tradition behind them. But anyone who has lived in the tropics can recognize the need for plastic hinges, catches, locks, and other building hardware. Curtis, a big user of building hardware, being prefabricated millwork manufacturers, decided to attempt a technological, design, and merchandising break-through by making a complete catch and lock for a convertible window unit out of molded nylon.

The seven parts of the lock are molded from regular nylon by Du Bois Plastic Products, Inc. and are then dyed brown to accommodate customer prejudice. The item is new but has worked so well from the standpoints of strength, freedom from lubrication, and quietness that it will probably be a forerunner of a great many building hardware items. Curtis has applied for patents on the design.

Nylon does not always compete with non-plastics materials. This is especially true in the consumer

Specialized bearing has thin nylon skin (pencil) molded into metal shell

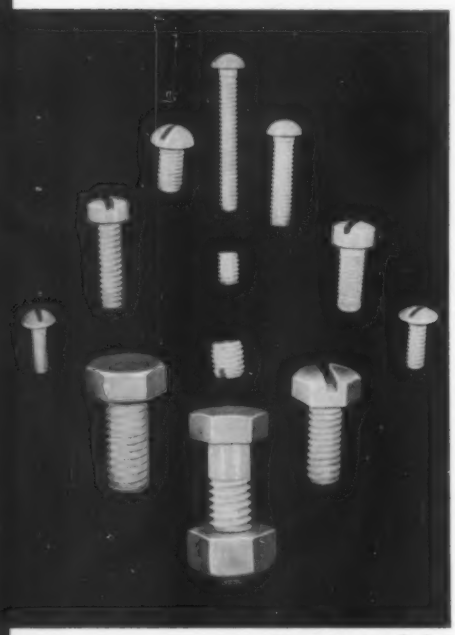


Courtesy Heyman Mfg. Co.

Nylon strain relief bushing, formerly made of two molded nylon parts, now has thin nylon connecting link

Courtesy Anti-Corrosive Metal Products Co., Inc.

Over 200 varieties of nylon bolts and nuts are manufactured by one company for uses requiring light weight, resiliency, electrical insulation, and other properties



Courtesy Nylogrip Products

Fasteners may be machined from nylon rod or made in multi-cavity molds

goods fields where available techniques and ease of handling other plastics have brought them into use, later to be superseded by nylon. General Electric Co. for some years made the silverware holders for their automatic dish washers out of vinyl coated wire mesh. Extended use sometimes exposed the bare wire to create rust. And the holder had to be attached to a stainless steel shell, which was costly.

Now the piece is all-nylon, a solid molded part, with an actual saving of some 15 to 20% in cost since the stainless steel shell, and attendant assembly labor, was eliminated.

The high heat distortion point of nylon, its good detergent resistance, and the fact that it is extremely rugged in thin sections have made the application successful.

Fishing Reels

Another consumer item which has for some years been moving toward increased use of molded nylon components is the fishing reel. Low inertia—preventing back lash in fast moving parts—corrosion resistance, light weight, and plain "guts" are the reasons for its success in the field. One of the original users of nylon in spinning reels is South Bend Bait Co., South Bend, Ind., and the company's latest nylon product is a spinning reel seat which represents a new use for the material. The item is made in three parts: a slit cylinder to be compressed to the handle of the rod and two tapered molded grippers or reel bands which slide over the seat and hold it in a vise-like grip until retracted. In use, the side wall design and tapered ridges molded inside the sleeve prevent any twisting or canting after the reel is mounted; other molded grooves outside the sleeve, keep the reel firmly in position. *Consumer Reports* gave South Bend's spinning rod, which incorporates this reel seat, a "best buy" rating.

Extruded nylon tubing is used in automatic pressure lubrication systems for cars. It flexes without fatigue, will not corrode, and serves over a wide temperature range

Courtesy Barrett Div., Allied Chemical & Dye Corp.

Hospital Utensils

Resulting probably from the successful use of nylon in brushes, combs, and tumblers, nylon has recently moved into the field of proprietary hospital utensils such as emesis basins, wash basins, bedpans, medicine cups, and forceps jars. An especially carefully colored form of Zytel resin in aqua, gray, peach, and natural was developed.

The new hospital utensils have the advantage of light weight and extreme toughness. They are not affected by autoclaving, cold sterilization, or detergents. They are not damaged by such corrosive materials as bichloride of mercury, sodium hypochlorite, or sodium hydroxide. They are resistant to alcohol, alkalies, and dilute acids—and a plus value is lower noise level in hospitals where these items are in use. They are manufactured by Zylon Products Co., Inc., Providence, R. I.

Industrial Components

Especially designed industrial molded nylon components are being ever more widely accepted. Proprietary molded products and parts for products are swinging to nylon too. A third most important field is that of proprietary industrial parts such as bearings, fastenings, bolts

(*To page* 204)

Vinyl in a New Art Medium

VINYL-BASED pigments, similar in appearance to oils and used in conjunction with vinyl-coated canvases, have been introduced by Vinyl Art Supply Corp., Argyle, N. Y., as the latest in art media.

To the artist, one of the most advantageous properties of the new material, known as "Vasco," is its ability to set up or fuse under a brief, simple application of heat. Most other art media require lengthy drying periods.

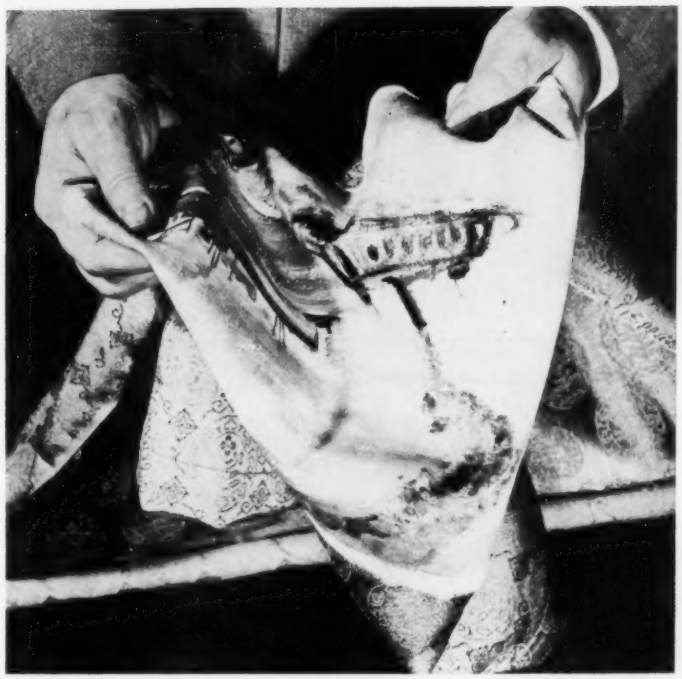
After the painting has been completed by the artist, or at any stage during the painting, the heat can be applied with a heat lamp, in a kitchen oven at 350° F., or with an electric iron set for the "cotton" ironing range and applied to the unpainted side of the canvas. The entire fusing operation takes only 2 to 5 min., depending upon the thickness of the paint, and serves to bond the vinyl-based pigment so firmly to the vinyl-coated canvas that even if folded double, the paint will not crack or separate from the canvas. The bonding operation also makes the paint impervious to water so that the finished canvas can be safely washed.

The new pigments, which are adaptable to nearly every type of art work, are applied to the vinyl-coated canvas with a conventional brush or palette knife. Even if they are left exposed on the palette for weeks at a time, they will not set up unless heat is applied. This is especially important on jobs where delicate colors have been specially mixed by the artist, and also serves to eliminate waste.

The pigments, priced competitively with oils, are packaged in conventional tubes. They are not compatible with other art media and a non-absorbent material, such as glass, metal, or vinyl is recommended for a palette. A special thinner to reduce the viscosity of the pigments is also available.

Thirty-two paintings done in this medium were recently exhibited in New York and met with approval.

CREDITS: Vasco pigments are based on Geon vinyl resins supplied by B. F. Goodrich Chemical Co.; pigments, vinyl-coated canvases, palettes, thinners, etc. are available from Vinyl Art Supply Corp., Argyle, N. Y.



After the fusing operation, paintings done with the new waterproof vinyl-based pigments can be wrinkled and even folded double without cracking or separating

Photos courtesy B. F. Goodrich Chemical Co.

Pigments based on specially formulated vinyl resins can be fused to a vinyl-coated canvas by applying heat from an iron to the unpainted side of the canvas

FRAMED IN REINFORCED PLASTICS

Courtesy Foster & Kleiser Co.

Molding trim made of reinforced plastics provides rugged, corrosion-resistant, and easy-to-maintain frame for outdoor billboard posters

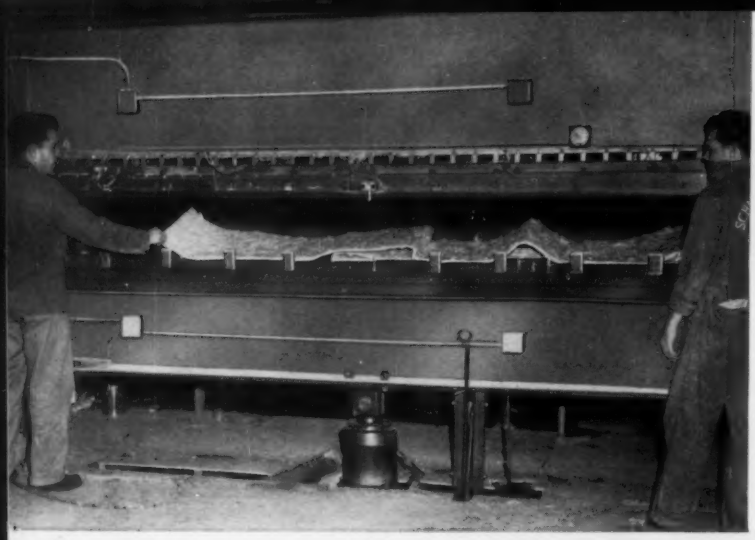
OUTDOOR billboard posters now can have neater, more practical frames through the use of a weather-resistant molding trim made of reinforced plastics.

In comparison to wooden or metal frames, the new trim offers several outstanding service features. Since color is permanently molded into the reinforced plastics parts, the trim never needs painting. It is also reported to be more resistant to corrosion, temperature extremes, and general weathering than any of the conventional types of frames presently in use.

Another advantage that the reinforced plastics molding has over other materials is its freedom from attack by billboard paste. The trim will never be stained, mottled, or otherwise blemished by corrosive components in the paste. In addition, although the paste will generally not stick to the trim it can easily be scrubbed off if it does.

While more resistant to denting, chipping, and other damage, the rugged reinforced plastics trim is still lighter than wood or metal and consequently is easier to handle, more economical to ship, and easier to erect.

After being molded (see Figs. 1 through 4) and finished (Fig. 5) to conform in size and shape to stand-



1 To produce the reinforced plastics molding, long strips of fibrous glass mat, approximately 14 in. wide, are first manually laid in place in the lower half of a 13-ft. steel molding die. The die is mounted on an electrically controlled hydraulic press especially built for this operation

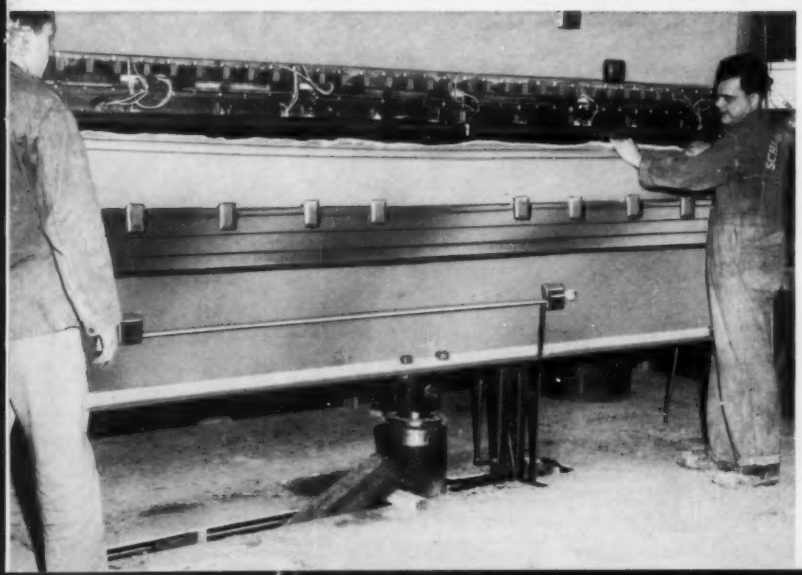
2 In order to reduce the amount of trim on the finished molding to a minimum, two operators, working from both sides of the narrow press, carefully tuck the loose edges of the fibrous glass mat into the corners of the steel die

ard specifications, the trim is packed in a container that holds six separate pieces—two each for the top and bottom of the sign and one each for the sides. Also included in the package is all necessary hardware for conveniently attaching the trim to the wooden boards of the sign. The plastic trim can be sawed, punched, drilled, or riveted for ease of mounting and installation.

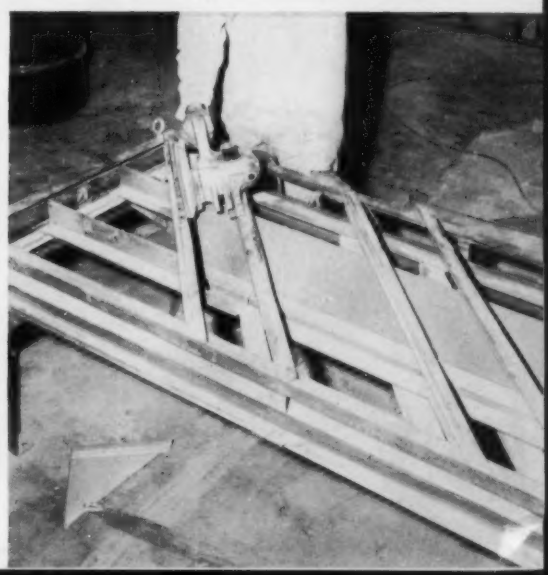
CREDITS: Trim molded by Kimball Mfg. Corp., San Francisco, Calif., for billboard companies throughout the United States. Fibrous glass is supplied by Owens-Corning Fiberglas Corp., polyester resin by Bakelite Co.

3 Liquid polyester resin, pigmented gray, is then distributed carefully over the fibrous glass mat in the die. Approximately 2 gal. of resin are required for each separate section of the molding trim

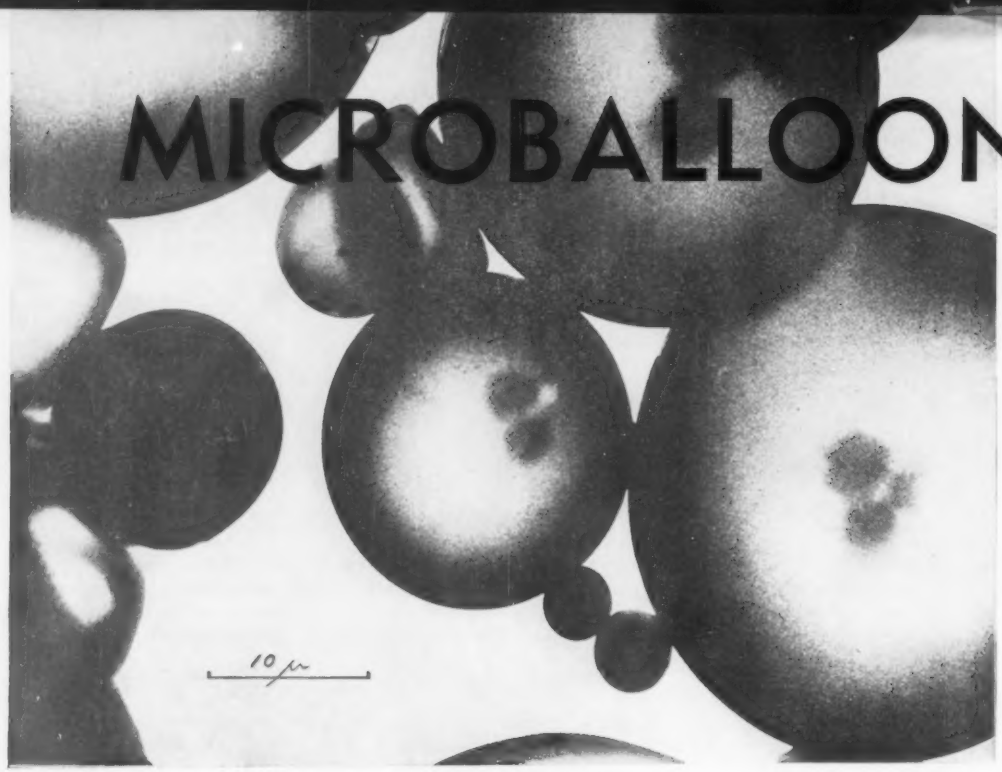
4 Following impregnation of the fibrous glass mat, the upper male die is lowered into the mold, forcing the resin uniformly throughout the material. After a 3-min. cure at a pressure of 50 p.s.i. and a temperature of 250° F., the hardened piece, approximately 3/32 in. thick, is removed from the lower half of the die



5 Molding is finished by removing excess trim with a band saw and then mitering the corners on a specially designed jig (below) so that the top, bottom, and sides of the frame can be assembled with mated joints



MICROBALLOONS:



All photos courtesy Bakelite Co.

Microballoon particles (magnified view above, as seen under an electron microscope) are tiny hollow spheres of plastics (generally phenolic or urea), ranging in diameter from 0.0002 to 0.0036 in. and filled with inert nitrogen gas

TINY nitrogen-filled spheres of plastics ranging in diameter from 0.0002 to 0.0036 in. are attracting considerable attention because of their outstanding potential as low-density fillers for controlled foams, for sandwich-core structures, and for various types of castings.

Trademarked "Microballoons" by The Standard Oil Co. (Ohio) and originally developed as a floating barrier to minimize evaporation losses from cone-roof oil storage tanks, the inherent strength, light weight, and insulating properties of the plastics spheres have led to their consideration for a wide variety of other applications, especially concentrated in the field of expanded plastics.

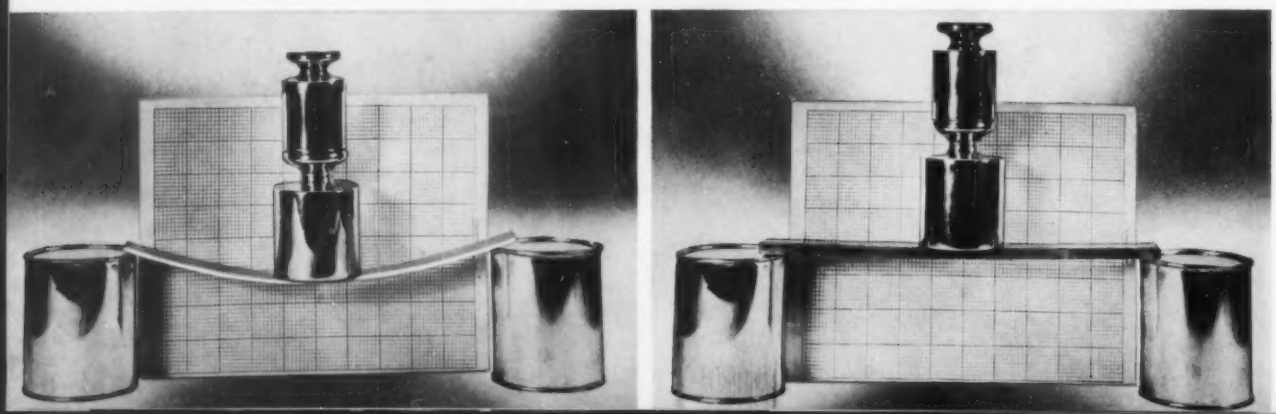
The two licensees of The Standard Oil Co. (Ohio) in the manufacture of the Microballoons are: Bakelite Co., Div. of Union Carbide and Carbon Corp., New York, N. Y., producers of phenolic spheres; and Colton Chemical Co., Div. of Air Reduction Co., Inc., Cleveland, Ohio, producers of Colfoam spheres based on a specially formulated urea formaldehyde resin.

Both manufacturers state that, in addition to phenolic and urea, the Microballoons can be made from a wide range of materials with properties to suit specialized applications. Experimental work on Microballoons made from such film-forming materials as polyvinyl acetate, polyvinyl alcohol, and inorganic sodium silicates is already in the laboratory testing stage; investigations into the possibility of making Microballoons from other plastics materials are expected.

Low-Density Filler

Microballoons were introduced as a floating barrier to the oil industry about two years ago and this application still ranks as a major market. When poured into a crude oil storage tank, the Microballooon spheres rise to the top of the oil

Strip of polyester-fibrous glass laminate, about 0.12 in. thick, bends under load (left); under same conditions, a sandwich structure of same weight, made of reinforced plastics faces bonded to a Microballoon foamed core, shows little deflection (right)



A Progress Report

where they form a sealing layer that reduces the evaporation of oil considerably. The floating characteristics of the seal permit it to rise and drop as the level of the crude oil is raised or lowered. Results of tests—both in the laboratory and in the field—have indicated that the spheres can reduce oil evaporation losses from storage tanks approximately 80 to 90 percent.

After this introduction, the properties of the Microballoons immediately suggested a number of other possible applications.

As a lightweight aggregate or filler for plaster, for example, laboratory tests have shown that the quality of the plaster is so improved that nails can be driven through it without cracking. Similarly, small percentages of Microballoons can be used during the production of concrete to aerate the material uniformly and thus increase its wearing qualities as well as its weather resistance.

Because of the low thermal conductivity of the plastics spheres, insulating applications are excellent possibilities. With suitable binders, thermal insulating wall boards, floor coverings, ceiling tiles, and other products can be formulated. And because of the low particle density of the spheres (bulk density is 18 to 20 lb./cu. ft.), they can be used for floats and other lightweight applications.

Controlled Foams

Perhaps the greatest potential use for the Microballoons, however, is in the production of controlled foams and sandwich-core structures.

By bonding the microscopic hollow spheres together with phenolic, epoxy, or polyester resins, a uniform structure can be obtained that is remarkably free from voids, dense areas, and brittle skin.

To make the foam, the thermosetting resin, usually polyester, is first mixed with a catalyst and accelerator. The Microballoons are then added and the mixing operation continued until the components are well dispersed. The resulting product is a thick, putty-like mass that can be trowelled or otherwise worked into a suitable mold and cured at low pressures and temperatures. The cured foam is a strong, lightweight, uniform block suitable for immediate use in various applications.

Where the foam is to be used as a sandwich-core structure, the putty-like mass can be forced into intricate spaces or sandwiched between skin membranes of reinforced plastics or low-pressure laminate stock and the entire assembly then cured.

For use in stiffening hollow aircraft wings, a "featherweight" foam, with densities ranging from 10 to 14 lb./cu. ft., has been developed by Bakelite Co. Requiring no catalyst, the foam uses pulverized phenolic resin as the bonding agent. The resin and the spheres are mixed together in a blender and the mixture, which flows like fine sand, is poured into a suitable mold and cured at 120° C. for 2 hours.

Advantages

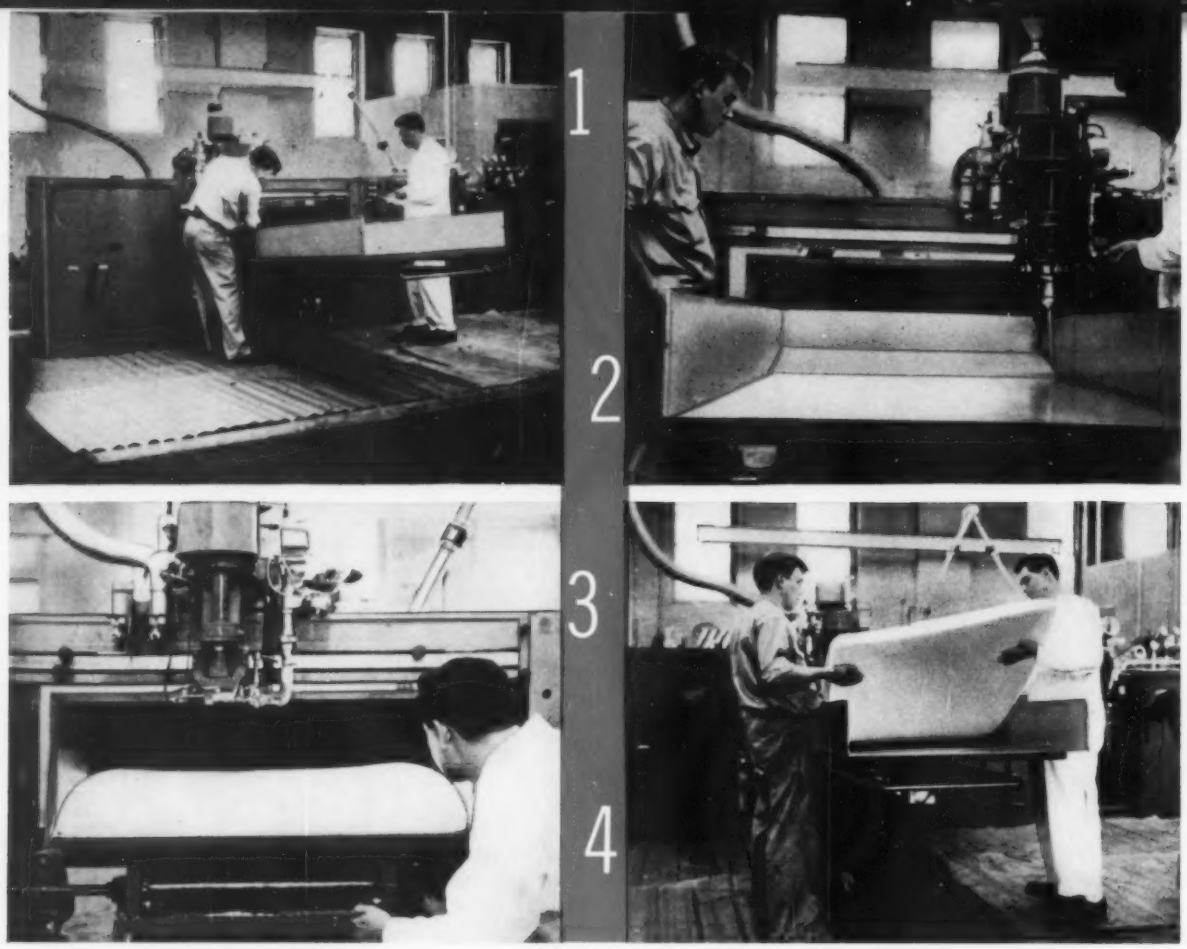
As the name "controlled foams" implies, the basic advantage of Microballoons in foams is that they can be mixed with a binder or matrix material formulated to dry or harden at almost any desired rate and that this rate can be completely controlled throughout production. With foams made by expanding a mass of material, split-second timing by the operator is usually essential to proper performance.

In addition, the spherical shape of the Microballoons, as contrasted with the polyhedral shape of the cells in a true foam, enhances the strength properties of the new foams, and the sealed-in inert gas, which is essentially nitrogen, provides the foams with inherent thermal insulating properties. Unlike true foams, in which about half of the cells are connected, all of the cells in foam based on Microballoons are closed.

Because of their low density, sandwich core structures using Microballoons as filler can save up to 50% of the cost of polyester resin-reinforced structures, without sacrificing strength or rigidity. In tests conducted by Bakelite, low-cost sandwich structures were made with reinforced plastics skins and foam cores based on Microballoons that showed flexural strengths ranging from 1700 to 4500 p.s.i., tensile strengths between 1600 and 2900 p.s.i., and compressive strengths as high as 12,100 p.s.i.

The new foams are suggested for reinforcing boat hulls, for insulating air-conditioning units and refrigerators, for stiffening airplane wing structures, and for other end-use applications where a combination of strength and light weight are prerequisites and where costs must be held to a minimum.

In making foam, putty-like mixture of Microballoons, polyester resin, and catalyst is troweled into a mold (below). At room temperatures (or by applying heat), the mixture cures into a strong uniform block of foam (right)



FROM LIQUID TO FOAM IN FOUR MINUTES—Moving head type machine (1) for producing polyurethane foam is ready to start a run; mold is in retracted position. As production starts (2), the mixing head moves across the mold and the mixture of chemicals starts to flow. The mold, waxed to facilitate later removal of foam, travels into the machine and, by the time it is half filled (3), foaming action at far end has been completed. At end of run, mold is retracted and slab of foam (4) is removed

Polyurethanes on the way

Wide-spread applications are predicted for materials that can be foamed, molded, and used in surface coatings, adhesives, and synthetic rubber

EVENTUAL use in upholstery, carpet pads, insulation, clothing, falsies, wire enamel, glue, gears, industrial truck tires, perhaps even passenger car tires, and a host of other consumer products are predicted for the polyurethane resins. More details were revealed recently than at any previcus time in the United States, when Mobay Chemical Co. pulled back the curtain on its new materials during a presentation at its St. Louis, Mo., headquarters.

Mobay Chemical Co. was formed in 1954 by Monsanto Chemical Co. and Farbenfabriken Bayer, A.G., of Leverkusen, Germany. The Bayer company has been in commercial production of the chemicals used for polyurethanes in Germany for more than three years. Until the Mobay demonstration, there had been no full-scale exposition of the polyurethane situation in the United States, although thousands of words have been written concerning its possibilities and various companies have given out partial information regarding activities in this field.

The Mobay plant, where the chemicals for polyurethane resins are to be produced on a 200-acre site near New Martinsville, W. Va., is scheduled to come into production this fall with a rate of several hun-

dred tons a month. The plant will have a personnel of about 150 in production and maintenance and 50 in research, with an annual payroll of over $1 million.

Technical Know-how

Toluene-type isocyanate and adipic acid-type polyesters will be produced at this plant. In most cases, the customer will buy both and react them together to produce polyurethane. In addition to the principal chemicals involved, Mobay will also produce the necessary activators, modifiers, and catalysts, as well as furnish technical know-how and the machinery for producing foam under license agreements.

Presently the isocyanate chemicals are being produced by Monsanto in a small-scale plant at Anniston, Ala., and are also imported from Germany. In addition, there are several other companies in the United States producing isocyanates and the necessary polyesters to go with them, but the total business done by all of them is quite small when compared to other plastics operations. The industry is still a little chick that has barely emerged from the egg.

Flexible Foam

By far the biggest use for polyurethane now and in the immediate future is foam, both flexible and rigid. By next year, Mobay's licensees will have installed and in operation sufficient foaming machine capacity to make a pile of flexible foam a city block square and 40 stories high. Licensees include the Dryden Rubber Div., Sheller Mfg. Corp.; Dunlop Tire & Rubber Corp.; W. T. Burnett & Co., Inc., a cotton batting producer; Goodyear Tire & Rubber Co.; American-Collo Corp. (see MODERN PLASTICS, June 1954, "Polyurethane Foam," p. 258); Dayton Rubber Co.; Nopco Chemical Co.; and Albert Trostel & Sons Co., Inc., a leather-tanning company in Milwaukee, Wis. Prior to the formation of Mobay, Farbenfabriken Bayer had licensed B. F. Goodrich Co., General Tire & Rubber Co., and Curtiss-Wright Corp. It is significant to note the different kinds of industries included in this list.

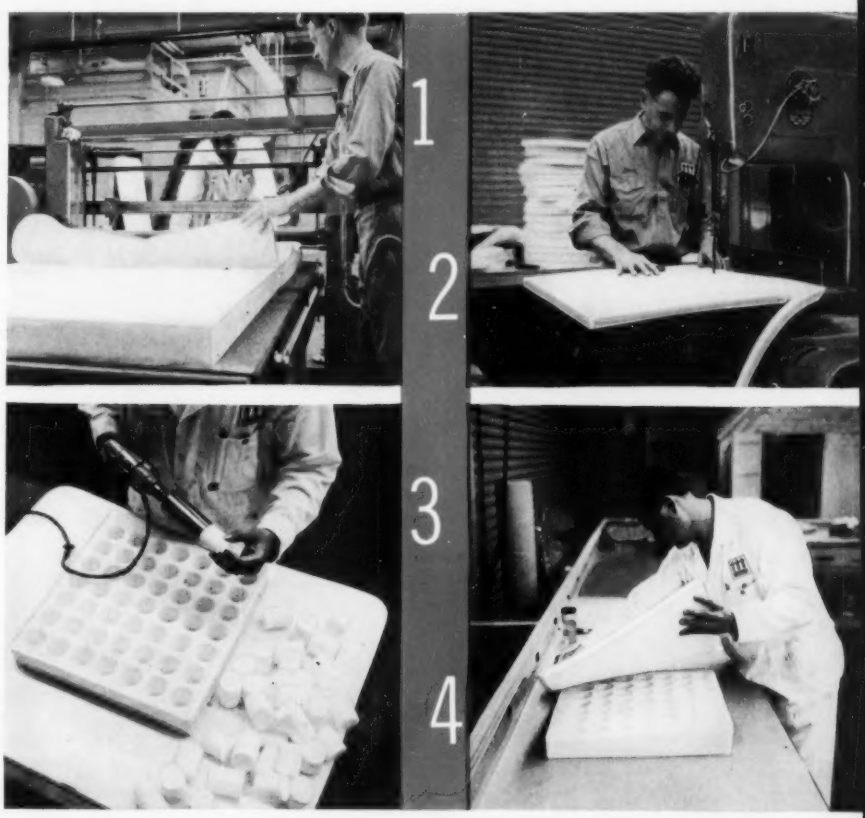
Flexible urethane foam looks so much like a fine, uniformly grained rubber foam that it is hard to tell the two apart by looks alone. It can vary from extremely soft to very hard; its "bounce-back" after compression can be regulated easily in the manufacture; it can be varied in weight from as little as 2 or 3 lb./cu. ft. to as much as 20; it is easily laundered, mechanically tough, can be sewn by hand or machine, resists all commonly used cleaning solvents, and is relatively unaffected by exposure to air or sunlight.

Uses for Flexible Foam

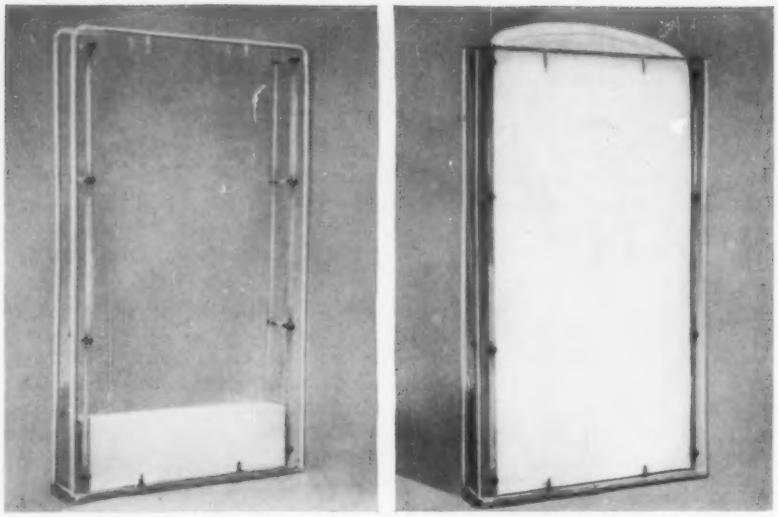
Most of the applications for which urethane foam is useful have been discussed in previous issues of MODERN PLASTICS. (See American Collo Corp. mentioned above; "Polyurethane and Polyester Foam," November 1954, p. 106; and "3 New Foams," April 1953, p. 85.) A very recent use that has been receiving raves is cored foam for seat cushioning in airplanes. Currently, the cores are being cut out by hand with a circular automatic knife, but eventually they will be punched out on a press to save time.

Polyurethane cushions are lighter than rubber latex, are flame resistant, and, because of slow "spring-back" after compression by the sitter, provide a firm seat. These same factors make them ideal for automobile seats, for pads on operating and X-ray tables, and as "topper pads" in the construction of innerspring mattresses. Furthermore, the foam provides excellent ventilation. No attempt is being made to sell polyurethane foam as a complete mattress, but it is being used as the pad in mattresses to supersede cotton batting.

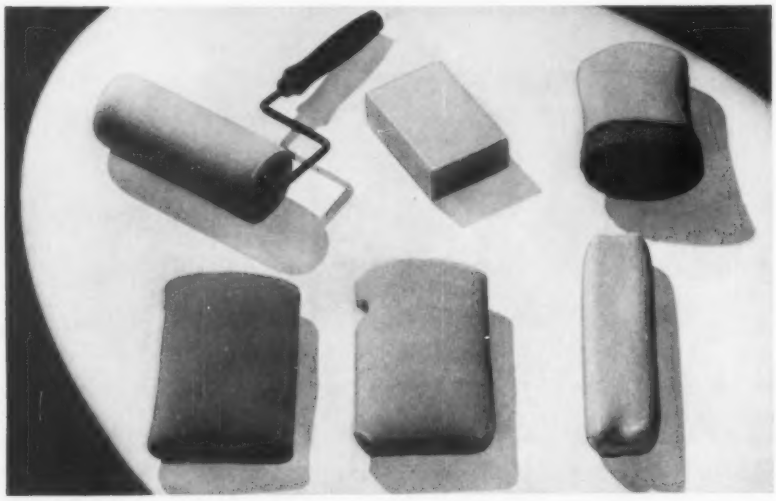
Its prospective use as shoulder pads, inner lining for clothing, and carpet underlay is expected to assume huge volume when the material is available in larger quantity. When used as an underlay, urethane



FABRICATING A SLAB OF FOAM—Steps in production of a cored seat cushion illustrate ease with which foamed slabs can be machined with simple tools. A horizontal saw blade (1) is used to slit the slab and the resulting sheets or blocks are cut to shape (2) on a standard band saw. Cores are cut through the shaped block with a circular saw blade (3) and a "topper" pad (4) is cemented to the cored block to complete the cushion. Airline operators are reported to favor back and seat cushions made of polyurethane foam because of long life, comfort, and important savings in weight



Speed at which the foaming action takes place in the production of a rigid urethane foam is demonstrated by the use of a transparent mold. Mixture introduced into mold (left) expands 16 times in volume to more than fill the cavity (right) within one minute



Applications in which flexible urethane foams can be used are many and varied. Household possibilities (above) include paint rollers, sponges, scrubbing pads, polishing pads, bath mitts, and floor brushes. Toys (below) can be formed in closed molds, are strong, soft, easily cleaned

All photos with this article courtesy Mobay Chemical Co.

foam requires no fabric backing. There is no need to mold it to finished thickness as with other materials. The joints can be easily taped and it provides sufficient friction to prevent crawling. The material can be cemented to rugs so that the rug can be laid and removed in a single operation.

There are scores of uses for flexible urethane foam other than those named above, including hydrophobic sponges (they can take up water without absorbing it) which are tougher than other types. Mobay spokesmen think its greatest significance is in uses other than just competition with rubber latex, consumption of which was around 180 million lb. last year. For example, the shoulder pad competition is with cotton wadding since latex cannot be sewed and is too heavy. Shoulder pad cutting machines are already being imported from Europe so it seems obvious that the competition is favorable on a cost basis.

Production Machinery

Machinery for the conversion of raw materials to the finished foam is available to licensees from Mobay, but the process is highly critical and requires experienced know-how for production. Within three seconds after the chemicals are combined in the proper amounts, foaming action starts (amounting to an expansion of the original volume by 40 times) and the entire action is completed in about 30 seconds. Without proper control, foaming action would begin to take place within the machine itself.

A variety of types and styles of machines are available. They range from small, fixed-head machines to machines capable of turning out blocks of foam 78 in. wide and 9 in. thick in continuous lengths. On the demonstration machine, a block of foam 40 in. wide, 9 in. thick, and 6 ft. long, was produced in less than four minutes.

The urethane foams, whether flexible or rigid, are prepared from polyesters, diisocyanates, and water. The mechanical characteristics of the foam depend largely on the choice of polyesters. By varying the degree of branching, one can prepare either flexible or rigid foams. The diisocyanate reacts with the polyester, converting that low-mo-

(*To page* 212)

Fig. 1 (right)—Cameo Carrier pickup truck, with reinforced plastics parts laid out. These parts include rear quarter panels, front fender panels, spare tire carrier, and tail gate cover

Fig. 2 (below)—Pickup truck, with reinforced plastics parts in place. Sleek, streamlined appearance of vehicle is largely due to design potential inherent in reinforced plastics; compare with Fig. 3 (below, far right), showing conventional pickup truck, without reinforced plastics parts

Photos courtesy General Motors Corp.

Fig. 3

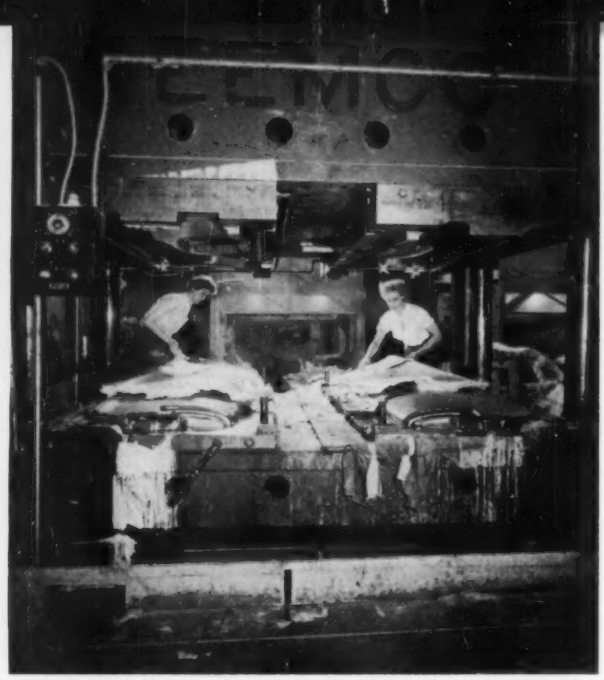
Glamour Truck

Chevrolet breaks the rules again and produces a pickup truck with all the beauty, luxury, and style of a passenger car—with fibrous-glass reinforced plastics parts

FIBROUS-GLASS reinforced plastics rear quarter panels, front fender panels, spare tire carrier, and tail gate cover, are now being produced for a special new pickup truck known as the Chevrolet Cameo Carrier, which is as close to a passenger car as a pickup truck can be in beauty, luxury, and style.

When Chevrolet stylists and engineers first conceived the idea of this truck, they had no accurate way of determining the volume of business such a super deluxe pickup would create. If the total volume were in excess of 15,000 units, the cost to make these parts in steel, including tool amortization, would be less than in molded reinforced plastics; below 15,000 units, the cost advantage was with the plastic parts.

There are other factors involved besides the cost which helped to swing the decision to plastic. Several months less time would be required to tool the job and get it in production in reinforced plastics than in steel. Some contour details that would have been difficult in steel were easy in plastic. The advantages of reinforced plastics in resistance to denting and corrosion would be most appreciated by people who



Photos courtesy Molded Fiber Glass Body Co.

Fig. 4—Resin is poured over two layers of 2-oz. glass mat; after it is spread, layer of 1½-oz. mat and overlay mat are put on top

Fig. 5—Resin-impregnated fibrous glass mat assembly is then placed in molds. Here operators are shown removing two molded parts from press

would consider buying a pickup truck for beauty, styling, and durability. Further, the Chevrolet's experience with reinforced plastics in the Corvette showed that the material would stand up in use and could be assembled and painted without too much change from sheet metal practice.

New Problems

There were a few new problems to face with the truck parts that were not encountered with the Chevrolet Corvette. First, trucks are assembled at ten assembly plants throughout the country and several different types of trucks will go down the assembly line one after another. The Corvette is assembled at only one plant.

Second, passenger car lacquer finish baked at 180° F. is used on the Corvette while the synthetic enamel used on trucks is baked at between 250 and 275° F. Many resins that were satisfactory for the Corvette finish would not stand this higher baking temperature. Consequently, the body manufacturer, in cooperation with Chevrolet engineers, developed a new resin formula which will stand a 275° F. bake without deterioration or crazing and which also has high impact strength, high flexural strength and modulus, and high tensile strength.

For comparison purposes, Fig. 1 shows the Cameo Carrier with all the plastic parts disassembled from the pickup box, Fig. 2 shows the completed pickup truck, and Fig. 3 shows the conventional Chevrolet pickup.

Parts and Assemblies

The rear quarter panel is an assembly 88 in. long, 30 in. high, and 14 in. deep. Because of its design, it could not be molded in one piece. It is molded in three primary pieces, a top panel, which comes down almost to the horizontal line barely visible in Fig. 1, a side panel, which is bonded to the top panel about 2 in. above its bottom edge, and a rear panel, which is bonded to both the top panel and the side panel, with a dividing line through the center of the tail light.

A bonding piece, placed below the tail light opening and on the inside, laps over the rear panel and the side panel. The joint between the top panel and the side panel is roughly 88 in. long and is merely painted over; it does not have any chrome covering strip. After painting, the bond line is not visible. Technicians of both the body company and Chevrolet studied this bonding procedure very carefully to obtain a bond line that would not show through a painted surface.

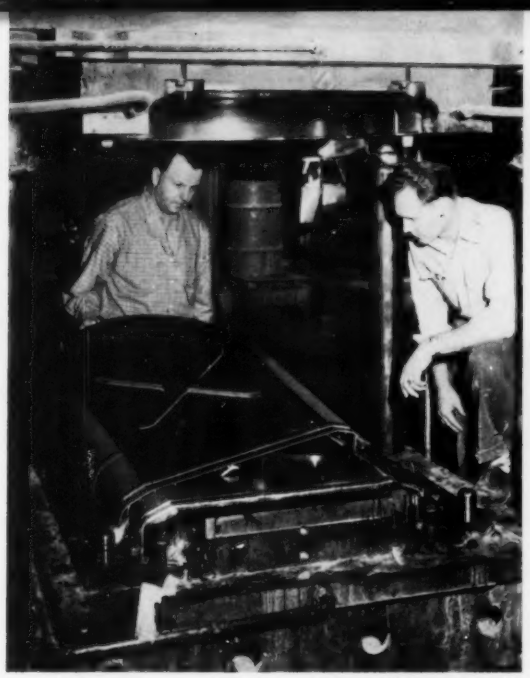
Preparatory, molding, and finishing steps are shown in the photographs. In Fig. 4, the operator is spreading resin on fibrous glass mat prior to putting the mat in the mold. Two layers of 2-oz. mat are below the resin. One layer of 1½-oz. mat is put on after the resin is spread; then a layer of 30-mil silane-treated overlay mat is put on top of the sandwich.

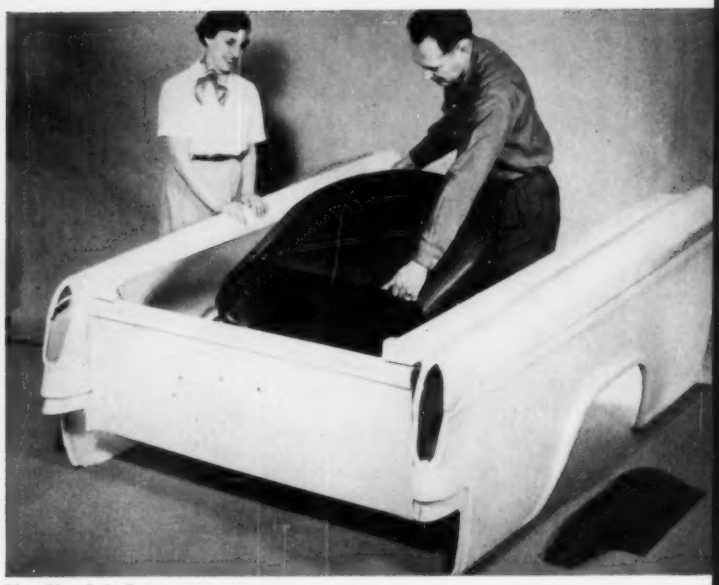
This whole assembly is then put in the dies shown in Fig. 5, in which photo the operators are removing two molded parts. In Fig. 6 are the dies for a half spare tire carrier and a molded piece. Back of the press is Robert S. Morrison, of the body manufacturing company; Hal Lathrop is at the side of the press.

Two pieces are bonded together to make a spare tire carrier, after numerous holes are punched by Wales Strippit punches. These various holes are for fastening the two halves together and for external and internal hardware. Some of the holes are visible in Fig. 7, which depicts a demonstration assembly of all the plastics parts in the relative positions they will take on the finished truck.

Figure 8 shows a left-hand and right-hand front fender panel which in Fig. 1 are beyond the quarter panels. This part is molded double and then cut in half. A number of assembly holes are punched in it, some of which are visible in Fig. 1.

The surfaces of the parts to be bonded together are sanded rough. A special viscous bonding mix using





Photos courtesy Molded Fiber Glass Body Co.

Fig. 6—Dies for one-half spare tire carrier, and molded part. Assembly holes are punched in part before bonding to other half

Fig. 7—Demonstration assembly, showing relative positions reinforced plastics parts will occupy on truck; man is holding complete spare tire carrier

a semi-flexible polyester resin is used and is spread through cones in much the same manner as tooth paste. The bonding fixtures are steam heated and about fifteen minutes is required to cure a bond. The spare tire carrier is not bonded under heat; the two halves are simply riveted together and the bond cures without external pressure or heat.

The tail gate cover consists of four pieces. The cap going over the top of the tail gate (see Fig. 2) bonds to the tail gate cover proper about 2 in. below the top of the tail gate. Two side pieces which are used to fasten the panel to the tail gate are bonded on but are not shown in the photos.

The resin used in all these Cameo Carrier parts is a low-shrink, high-strength, semi-flexible, flame-resistant resin. The resin mix contains from 33⅓ to 40% filler, depending upon the part, which gives the parts better high-temperature resistance. The higher filler content has not reduced the impact or other strengths but, combined with the low-shrink of the resin, it helps to obtain a surface that is somewhat smoother than the surface obtained on Corvette parts produced previously.

Problems Still Exist

An executive of the fabricating company made the following comments when asked what is still needed to further develop automotive uses for molded fibrous-glass reinforced plastics.

"We need a quicker, less costly way to bond molded reinforced plastics parts together. The necessity of sanding surfaces to be bonded considerably increases the cost of the bonding operation. We have not yet developed a method of putting hydraulic pressure on the bonding material the way we do on the polyester resin in the molding operation, using matched metal dies and hydraulic presses. The bonding material should have sufficient flexibility so that it will not surface craze when stretched.

"We further need a surfacing primer which can be put on molded parts without requiring complete surface sanding prior to painting for good adhesion. Some work has been done with polyester surfacings which also will fill minute pin holes at the same time. However, these polyester surfacing materials require sanding again before the final coat is applied and the polyester surfacing materials are much harder and require more sanding than do ordinary primer surfaces."

Chevrolet engineers are also working to reduce the problems mentioned. All involved feel that more use for molded fibrous glass parts in the automotive field can be developed if these problems are licked and if a gradual reduction in over-all costs can be achieved.

Courtesy Molded Fiber Glass Body Co.

Fig. 8—Left-hand and right-hand front fender panels (nearest wall in Fig. 1) are molded double, then cut in half; as with spare tire carrier, assembly holes are punched in part after molding

Drive-in Movies Feature Plastics

Weather-resistant plastics for in-car speaker housings and movie screens improve viewing and listening facilities

Courtesy Natco Wonder Screen Co.

Cinemascope screen, over 100 ft. in width, is made up of reinforced plastics sections bolted to a steel framework

WITH operators of drive-in movie theaters, the performance of plastics materials in improving viewing conditions and the quality of sound reproduction is winning as much applause as the performance of the Hollywood stars on their screens.

As a "bit player" some five years ago, plastics' only outlet in the drive-in movie field was in minor parts for in-car speakers; today, the role of plastics has been expanded to take in virtually the entire range of drive-in movie equipment—from the complete housing for in-car speakers to sweeping Cinemascope screens over 100 ft. in width.

Speakers and Screens

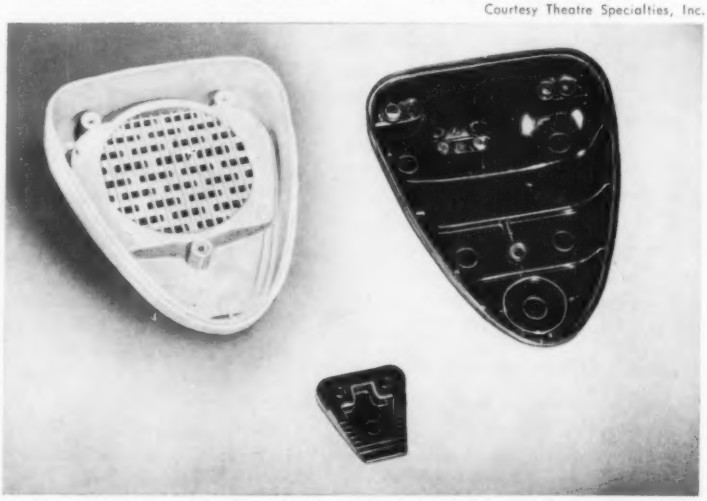
Currently, the large-volume application for plastics in the drive-in field are the molded cases for the speakers which are hung on the car door and the molded translucent or opaque junction box covers which protect the wiring, light sockets, and other electrical components installed on top of the upright speaker stanchions located beside each car.

Outdoor motion picture screens are a relatively new field for plastics but potentially an important one. The more than 20 reinforced plastics wide-curve Cinemascope screens that have already been installed have attracted a great deal of attention. Considerable interest has also been expressed in the possibilities of screens fabricated of white vinyl sheeting.

Volume-wise, the over-all drive-in movie field shows signs of developing into a substantial market for plastics. Drive-ins are probably the fastest growing medium of entertainment today. In 1949, there were

Bosses and other assembly features are molded into speaker hook (center) and into the front (left) and rear (right) sections of the butyrate speaker housing

Courtesy Theatre Specialties, Inc.



only about 900 such theaters in the United States with space for about 700,000 cars; in 1951, the total number of drive-ins jumped to over 3000 and car capacity rose to 2.3 million. Today, it is estimated that there are between 5000 and 6000 drive-ins with sufficient space to accommodate between 3½ and 4½ million cars . . . and expansion is expected to continue for a good many years to come.

Weather Resistance

The molded plastic speaker case, in contrast to the sheet metal type, offers advantages of appearance, economy, and performance.

By exploiting the design potential of plastics materials, speaker cases have been changed from the simple box-like affairs of about five years ago to streamlined, compact units that blend with the over-all modern design of the newer outdoor movies. There is no need for painting, enameling, or otherwise finishing the case once it has been molded. Color is integral and, unlike paint or enamel, cannot chip or wear off. A molded speaker case will last for years without losing its lustrous finish even when subjected to extremes of heat, cold, or humidity.

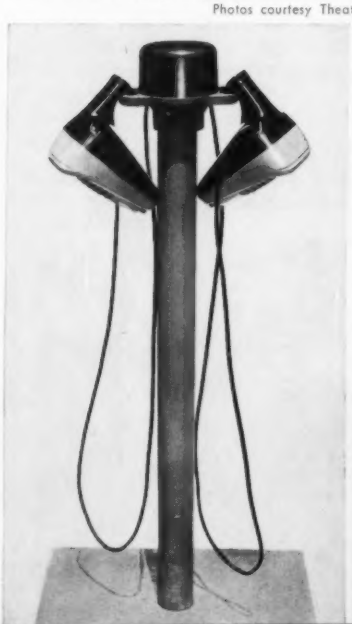
To the drive-in movie operator, this means a sizeable reduction in maintenance costs. The expense of frequent inspections of sheet metal cases, the necessity of touching up those areas that have been chipped, and the cost of annual repainting, when multiplied by an average of 700 speakers per drive-in, can run into substantial sums by the end of the year. With plastics, this maintenance problem is eliminated.

Although the rugged plastics cases will not warp, dent, or crack even under rough handling conditions, they are still lighter in weight than the metal cases. And there are no sharp edges that can scratch the car paint when the case is slipped over the window sill of the car door.

According to outdoor movie oper-

Courtesy Motiograph, Inc.

In-car speaker housing (top, left) is molded of phenolic in two parts—a front half (bottom, right) with molded-in handle and a deep rear half (bottom, left). Junction box for stanchion on which the speakers mount (top, right) is also molded of phenolic



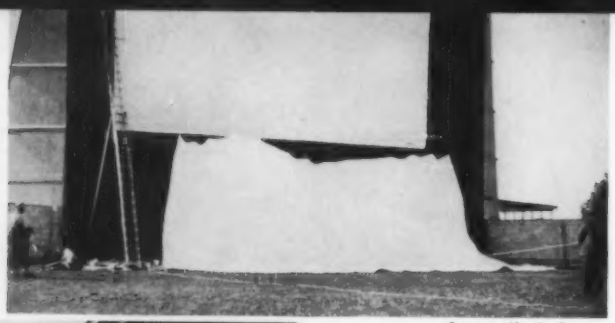
When not in use, butyrate speakers are conveniently hung on stanchion . . .

. . . when in use, the lightweight speakers slip easily onto a car door. Junction box cap is also butyrate

Photos courtesy Theatre Specialties, Inc.

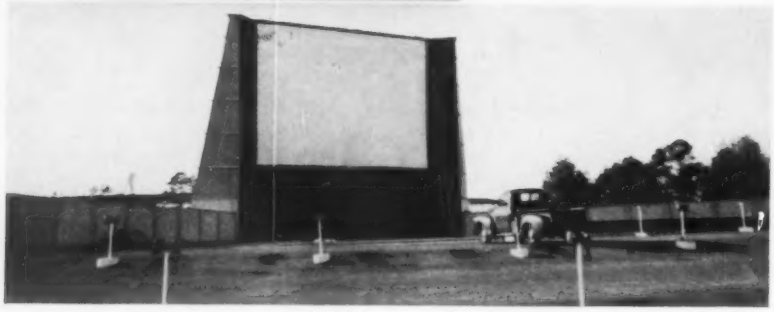
Courtesy Central States Paper and Bag Co., Inc.

Drive-in movie speakers are protected against cold, sleet, and snow by tough, flexible polyethylene film covers



Courtesy Plastic Creators

White vinyl sheet screen for outdoor movies is stretched across solid facing section (above) and laced tightly into place (left). Finished installation (below) provides good viewing conditions and has longer service life than conventional screens



ators, speakers in molded cases give superior sound reproduction to those in metal housings. Most of the plastics cases have molded-in assembly features that lock the various parts of the housing securely together to minimize vibration and rattling.

Butyrate Speaker

The speaker cases can be molded of many different plastics materials. Theatre Specialties, Inc., Los Angeles, Calif., for example, selected weather-resistant Tenite cellulose acetate butyrate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

There are five molded butyrate parts in their Bevelite drive-in speaker—front and rear sections of the housing, a rectangular yoke on which the 4-in. speaker unit is mounted, a volume control knob, and the rear hook which assembles to the end of the elongated neck of the rear section of the housing.

The front of the housing, including a handsome molded-in grille, is molded in grey material in a single-cavity mold; the rear of the housing, the volume control knob, and the rear hook are all molded in black in a three-cavity mold; and the speaker yoke, also in black, is molded in a two-cavity mold. All molds were made by Simplex Tool, Die, and Engineering Co., Pasadena, Calif., and all the parts are run on a 16-oz. H-P-M injection molding machine.

Molded-in bosses and openings make the assembly and servicing of the speaker case a simple job.

The rear speaker hook is fastened to the end of the housing neck with two screws. The two parts of the housing and the speaker yoke located inside the case are all fastened securely together with only three screws.

Weather-resistant butyrate is also used by Theatre Specialties to mold the translucent green cover for the junction box on the speaker stanchion. Illuminated from within, the translucent cover marks the speaker locations in the dark drive-in. The cover is molded in a two-cavity mold and is fastened to the die-cast aluminum base on which it rests with a single screw through a molded-in hole in its center.

Phenolic Speaker

Motiograph, Inc., Chicago, Ill., markets in-car speakers molded of phenolic supplied by The Fiberite Co., Winona, Minn. According to Motiograph, phenolic was selected because of its ability to take rough handling, because of the eye-appealing mottled mahogany color in which it can be molded, and because of sound reproduction quality.

The speaker case is molded by Northwestern Plastics, Chicago, Ill., in two parts—a shallow front with a molded-in handle that facilitates handling and a deep rear half into which the speaker unit fits. The two parts are assembled with only two screws. Molded-in supporting pins in the front housing securely anchor the speaker unit in place and prevent rattling.

Junction box covers are also molded by Motiograph in mottled mahogany phenolic and are available either with or without post standard and concession signal lights.

A third type of speaker housing is fabricated of polyester resin-im-

(*To page* 210)

New type of drive-in movie makes use of individual screens fabricated of bright white vinyl and stretched drum tight across a wooden frame. Rear projection is used

Courtesy Dallas Theatre

Molded Gasket Makes the Package

Saran film-wrapped vacuum packages for sliced meats are sealed with round or square gaskets molded of cellulose acetate

TWO plastics materials—saran film and molded cellulose acetate—play key roles in the success of a new type of self-service package for sliced luncheon meats developed and used by Oscar Mayer & Co., Madison, Wis.

To insure the freshness of the ½-lb. quantities of bologna, ham loaf, liver-cheese, and other sliced sausage and loaf products for which the package is intended, the principles of vacuum packaging are used. The meat slices are first placed on a metal base, similar to the end of a tin can, and covered with a transparent saran film wrap. A thin but tough gasket molded of red cellulose acetate is then slipped down over the film.

To complete the packaging operation, after the vacuum has been drawn, the edge of the metal base is crimped over the gasket (the saran film is caught tightly between the two parts), thus forming a secure, air-tight seal between the base and the film wrap.

Under the special process devised by Oscar Mayer & Co., evacuation and sealing of the packages is accomplished on regular can-closing equipment and machinery.

Film Wrap

Since the package is designed to provide complete protection for the meats, together with full product visibility and sales appeal, the saran film wrap, because of its grease-proofness, transparency, strength, and ability to retain a vacuum, has proved to be particularly effective. The film is drawn down tightly over the meat slices, in close conformity to the edges, so that there are no projecting margins to interfere with close grouping and convenient stacking of the packages in the self-service case of supermarkets, grocery stores, etc.

Acetate Gaskets

The acetate gaskets, which are molded either round or square in shape to correspond with the shape of the product being packed, are much superior to the paper gaskets originally used for this type of package. In addition to their inherent color, they are resistant to moisture and grease and are strong enough to withstand the vacuum drawing and crimping processes.

Slightly more than ¼ in. deep, the gaskets are molded with an exterior bead that provides a tight bond with the metal base when the two parts are crimped together. The gaskets are also designed with smoothly rounded edges that will not tear or otherwise damage the saran wrap.

They are molded in a 32-cavity mold and are specially packed so that they will remain flat during shipment to the various Oscar Mayer plants which are making use of this new type of highly effective vacuum package for sliced meats.

CREDITS: Gaskets are molded by Lind Plastic Products, Inc., Lincolnwood, Ill., using Tenite acetate supplied by Eastman Chemical Products, Inc.; saran film is supplied by The Dow Chemical Co.

Round and square gaskets, molded of acetate, are used to seal saran film wrapping of vacuum packed luncheon meat package to metal base

Top and bottom view of complete sliced-meat package. Use of saran gives package high visibility, acetate gasket assures a tight seal

Courtesy Eastman Chemical Products, Inc.

Courtesy Federal Tool Corp.

Courtesy The Dow Chemical Co.

Double-wall bowls by Federal have air pocket between styrene shells (cut-away, left). Tumblers by Gits are also double-wall

Double-Walled for Beauty, Utility

DOUBLE-WALL construction, based on two individual molded plastics shells separated by an air space, does much to heighten the sales appeal of plastics housewares.

While single-wall plastics housewares items have excellent insulation properties, the addition of an air pocket acts as a thermal barrier between two separate walls to provide more than *doubly* effective insulation for tumblers, salad bowls, pitchers, ice buckets, and similar containers for storing or serving hot or cold food products and various liquids.

Double-wall construction also contributes to the appearance of the plastics housewares. By using two shells of contrasting opaque colors or by combining opaque and translucent colored shells, housewares designers can create unusual new color effects.

Tumblers

In addition, housewares based on the double-wall design are considerably stronger and more rigid than the traditional single-wall-type product.

Tumblers are ideally suited for this type of construction. Because of the thermal air barrier, liquids in double-wall tumblers will be maintained at an even temperature, either hot or cold, for longer periods of time than is possible with conventional tumblers. At the same time, the barrier prevents condensation from forming on the outside of the tumblers and running down onto table tops or furniture covers and marring them.

When additional decoration is desired, such as in a set of tumblers being marketed by Detroit Macoid Corp., Detroit, Mich., decals can be applied to the outside of the inner shell. In this position, they are completely visible through the translucent or clear outer shells, yet are thoroughly protected from contact with liquids or from being smudged in any way by constant handling.

Tumblers from Detroit Macoid are available either with inner or outer shells both molded of tinted styrene acrylonitrile, with outer shell molded of transparent acrylic and with inner shell molded of opaque colored acrylic, or with both inner and outer shells molded of clear acrylic.

Tumblers styled by Reinecke and Assoc., Chicago, Ill., for Linwood Corp., Evanston, Ill., are molded with crystal clear styrene inner shells and opaque colored styrene outer shells. The clear thin inner shell extends above the colored outer shell for a highly decorative effect. Styrene is supplied both by The Dow Chemical Co. and Monsanto Chemical Co.

Also molding double-wall tumblers with inner and outer shells of styrene supplied by The Dow Chemical Co., are Federal Tool Corp., Chicago, Ill., and Crown Machine and Tool Co., Inc., Fort Worth, Texas.

Both Federal's and Crown's tumbler shells are cemented together around the top rim. Other manufacturers eliminate the cementing

operation by molding the shells to close tolerances and friction-fitting them together.

Pitchers

The second largest area of application for double-wall construction is in pitchers which are companion pieces to the tumblers. Both Federal Tool Corp. and Linwood Corp., for example, make available a combination double-wall pitcher and tumbler set, all molded of styrene.

Linwood's pitcher, as created by Reinecke and Assoc., is molded in three separate parts—the inner container, the outer container, and a detachable cover with molded-in ice cube retainer. The two containers are friction-fitted together and, if desired, can be separated for individual use.

Other double-wall housewares on the market include:

. . . an ice bucket molded of styrene by Columbus Plastic Products, Inc., Columbus, Ohio, in four parts—the inner and outer containers, a detachable cover, and a rim with molded-in handles.

. . . a hot and cold 2½ qt.-capacity server which doubles as an ice bucket or hot soup tureen and is molded by Kenro Corp., Fedonia, Wis., using Melmac melamine supplied by American Cyanamid Co.

. . . a series of bowls designed to keep salads, fruits, vegetables, ice cream, etc., chilled or warm, as desired. This latter category includes Thermo-Bowls molded by Federal Tool Corp.

. . . and a line of salad bowls molded by Leaf Plastics, Inc., Yonkers, N.Y., for Jay Don, Inc., New York, N.Y. The two shells of the Jan Don bowls, which are assembled by the interlocking action between a projecting rim on the outer shell and a grooved rim on the inner shell, can be separated if desired. Both Federal and Leaf mold their bowls of styrene supplied by The Dow Chemical Co.

Courtesy Reinecke & Assoc.

Matching tumblers for double-wall pitchers (left) have crystal styrene inner shell (right)

Courtesy Columbus Plastic Products, Inc.

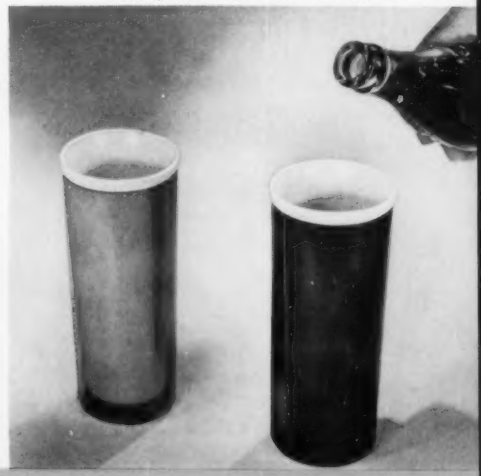
Molded rim (center) is cemented over ice bucket walls to hold them together

Attractive server is molded of melamine

Courtesy American Cyanamid Co.

Double-wall styrene tumblers keep drinks cold

Courtesy Crown Machine and Tool Co., Inc.



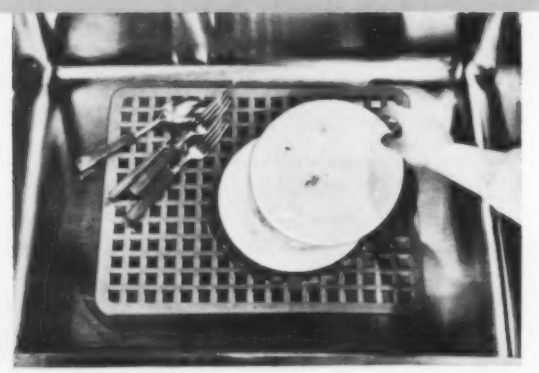
PLASTICS

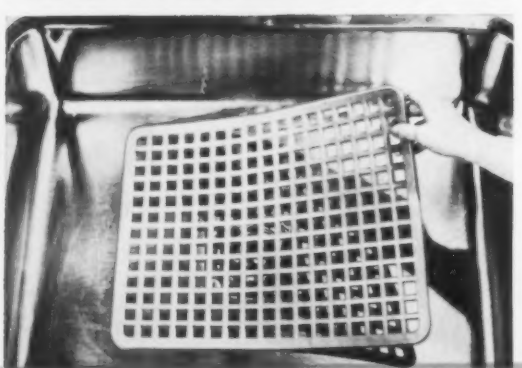
Insulated Outerwear

The use of expanded vinyl foam as a garment insulating material—a technique that proved so effective in the Navy Cold Bar suit—finds commercial application in the design of the Insulair Vagabond jacket and the Insulair Warmster vest. In addition to insulating the wearer against cold and wind, the vinyl foam lining is buoyant enough to float him. The jacket (left) weighs less than three pounds and is fabricated of a water-repellant nylon. The jacket, with or without a mouton collar, is available in navy, charcoal, red, and brown, and is especially suitable for hunting and other outdoor activities.

Designed primarily for active work or play outdoors, the vest (right), fabricated of cast vinyl sheet, allows unrestricted movement on the part of the wearer. It is available in red and black. The rear of the vest extends below the belt line to protect the small of the back from exposure.

CREDITS: Cast vinyl and expanded vinyl foam supplied by U. S. Rubber Co., Rockefeller Center, New York, N. Y. Garments by U. S. Rubber Co., Clothing Div., Washington, Ind.





Perforated Sink Mat

A lightweight sink mat that helps to reduce the danger of chipping or cracking dishes against hard porcelain or metal sink basins is molded in one piece of polyethylene. The flexible mat, perforated with an open-grid pattern, will cushion delicate dishes against the shocks of everyday dishwashing and will also prevent them from slipping and sliding in soapy water. Channels molded into the underside of the mat provide extra long gripping edges to anchor the mat in place.

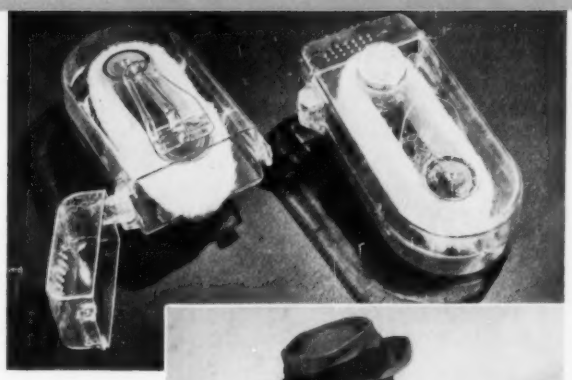
The polyethylene mat resists the oxidative decay which attacks other materials and makes them brittle or subject to cracking after repeated use in warm soapy water. It is also resistant to strong soaps, alkalies, detergents, water, foods, and greases.

The sink mat, which measures 16 by $11\frac{13}{16}$ in., is available in red, pink, yellow, white, green, and blue. It is molded in a single-cavity mold in a 12-oz. injection molding machine.

CREDITS: Manufactured by Rona Plastic Corp., 1525 Blondell Ave., New York 61, N. Y. Polyethylene by Bakelite Co., a Div. of Union Carbide and Carbon Corp., New York, N. Y.

PRODUCTS

Fishing Fly Selector Case

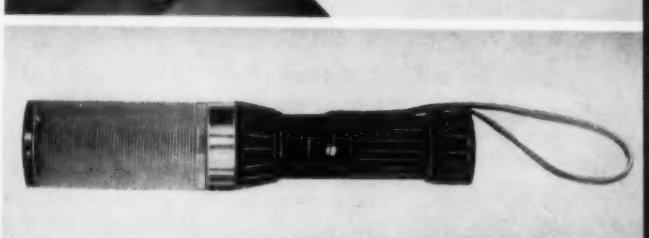


A butyrate container for fishing flies, called Fly-Bank, allows a fisherman to select and easily remove any particular fly using only one hand. The flies are attached to a wool belt mounted on a set of spools inside the container. Turning the knob on one side of the case rotates the belt. When the desired fly reaches the hinged snap-open top of the case, it can easily be picked off the belt. A butyrate pocket clip cemented on the back of the case allows the Fly-Bank container to be worn on belt or creel strap. A hole is provided in the rounded bottom of the case to permit water to drain out.

Fly-Bank is injection molded in two halves in a transparent amber color. The top, which is molded separately, is locked in place when the two halves are cemented together. This same assembly operation also locks in the two molded spools on which the belt rides. Holes in the ends of the spools serve as bearings for the short molded-in shafts on the inside of the case.

CREDITS: Molded by United Plastics Industries, Inc., 1300 Water St., Vassar, Mich. Butyrate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

Traffic Signal Baton



Traffic direction can be simplified by the use of a plastic Traffic Master signal baton that screws onto the head of a flashlight housing especially designed for this application and will emit either a red or a green glow depending upon the position in which the unit is held. With the exception of the translucent white butyrate cylindrical housing for the baton, most of the parts of the unit are molded or extruded of ethyl cellulose, including two concentric tubes in the center of the baton —a long translucent green inner tube and a short translucent red outer tube. When the Traffic Master is held with the baton pointing upwards, the red tube slides down until it covers the green tube and a red glow is emitted; when the unit is pointed downward, the red tube slides to the front of the baton housing leaving the base of the green tube exposed to a reflector unit that then emits a green glow. If desired, the baton can be removed and replaced with a special flashlight head.

CREDITS: Molded by Bright Star Corp., Clifton, N. J. Ethyl cellulose by The Dow Chemical Co., Midland, Mich. Butyrate by Eastman Chemical Products, Inc., Kingsport, Tenn.

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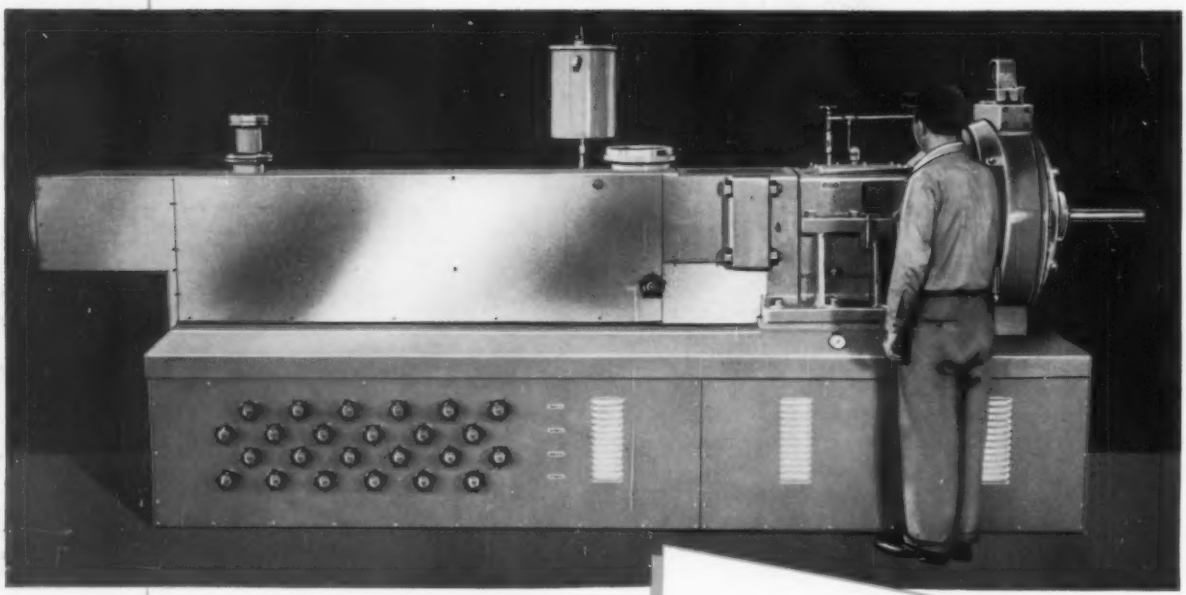

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THE NEW POLYETHYLENES

and their impact on fabricated parts

by DR. J. A. NEUMANN† and F. J. BOCKHOFF‡

STRIKING developments in the improvement of the basic nature of polyethylene have been announced during recent months. Several companies have been investigating and developing new types of high-molecular-weight polyethylenes having higher tensile strengths, higher temperature resistances, and greater rigidities than previously available polyethylenes. These new polyethylenes represent as great a stride in extending the versatility of polyethylene as did the first high-tensile steels in extending the adaptability of steel about 30 years ago. They are variously labeled "low-pressure," "high-modulus," "high-temperature," and "high-tensile" polyethylenes, but in the present article they will be referred to simply as HT (high temperature, high tensile) materials.

Two different processes have been used to manufacture the new HT polyethylenes. They differ principally from older methods in the much lower pressures required and in considerably higher catalyst activities. The Phillips method,[1] developed by Phillips Petroleum Co., employs as a catalyst highly hexavalent chrome oxide on a 10% aluminum - 90% silica carrier. The temperature of operation is about 155° C. The only pressure required is that necessary to liquefy the diluent, which is usually pentane or octane. This pressure may vary from 100 to 500 p.s.i. The enthusiasm extended by plastics users to the new Phillips product, tradenamed Marlex 50, has prompted Phillips Petroleum to begin construction of a 100 million lb. per year plant at Pasadena, Texas. In addition, Phillips is also offering licensee arrangements to interested parties.

The second basic method, developed by Karl Ziegler in Germany,[2] also involves an active catalyst. This catalyst is in the form of a metal-organic complex having the general structure $Me(R)_n$ where "Me" may be beryllium, aluminum, gallium, or indium, and "R," the organic radical, may be a hydrogen atom, an alkyl radical, or a monovalent aromatic radical. The temperature of operation in the Ziegler process varies from 60 to 250° C. and the required pressure may vary from atmospheric pressure to 2000 atmospheres.

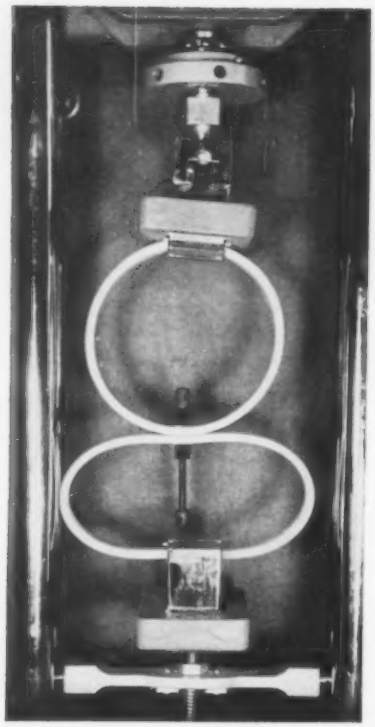
Several American companies have been licensed by Ziegler. One of the first of these companies to announce its new type of polyethylene was Koppers Co., Inc.; the Koppers tradename for its new material is Super Dylan. The general properties of Super Dylan are similar to those of Marlex 50. Koppers plans to have a plant in operation in Kobuta, Pa., by fall and expects to be in full production by spring.

Bakelite Co., a Div. of Union Carbide and Carbon Corp., which has also been licensed by Ziegler, expects to have a plant in full scale operation by spring in South Carleston, W. Va. Another Ziegler licensee, Du Pont, is constructing a new pilot plant at the company's Sabine River Works, near Orange, Texas. Fall production is anticipated. Monsanto and at least five other American producers have obtained Ziegler licenses and are rapidly developing their processes for commercial production.

Since the pressures required for the Ziegler and Phillips processes are much lower than those required in the conventional high-pressure polyethylene plant, the cost of the initial plant will be considerably lower. This cost should eventually be reflected in the price of HT polyethlyene. An eventual price of

Tube cast of HT polyethylene (6-in. dia., 3/16-in. wall thickness) has good rigidity

*Reg. U. S. Pat. Off.
† President and Director of Research, American Agile Corp., Maple Heights, Ohio; ‡ Assistant Professor of Chemical Engineering, Fenn College, Cleveland, Ohio.
[1] Belgian patent 530,617.
[2] British patent 713,081 (1951)



Strength difference of ½ in. wide sections of 6-in. dia. polyethylene tubes under compression loading; HT is at top

30¢/lb. appears economically realistic. Koppers expects to market its Super Dylan initially at 43¢/lb. in white and 46¢/lb. in colors.

Properties Compared

The improved properties of HT polyethylene are extremely interesting from the standpoint of structural fabrication. Tensile strength of the new HT polyethylenes can be as high as 6000 p.s.i. as compared with a maximum of about 200 p.s.i. for LT (low tensile, low temperature) polyethylenes produced by the older methods.

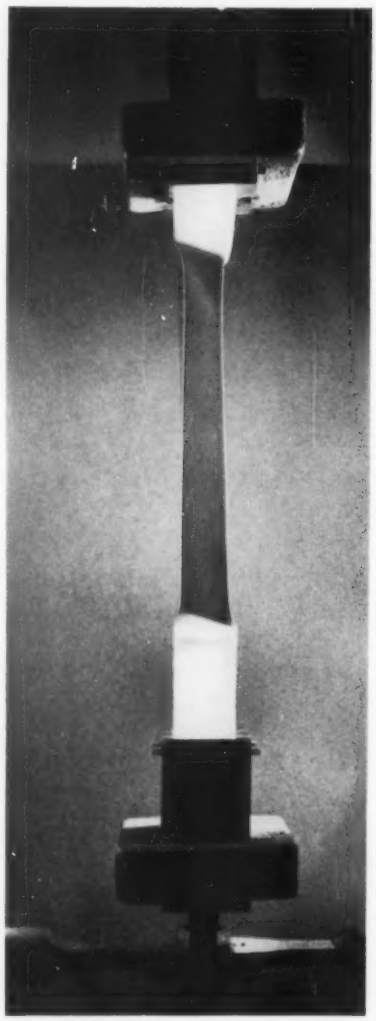
Elongation of some of the HT materials is as high as 1200 percent. It is interesting to observe that certain types of HT polyethylene, although exhibiting only 10 to 30% elongation at a pull of 6 in./min., will indicate an elongation of over 1000% when pulled at speeds below 2 in./minute. This phenomenon points to a definitely lower rate of molecular orientation under draw than the LT polyethylenes. In addition, the HT material, in the drawn form, is quite opaque. This contrasts with increased transparency found when drawing LT polyethylene.

The rigidity of the HT polyethylenes is definitely much greater than the rigidity of LT material. The stiffness modulus can be as high as 150,000 p.s.i. as compared with 30,000 p.s.i. for LT materials.

HT polyethylenes can withstand continuous temperatures of 250° F. Low-tensile polyethylenes have a softening point of about 220° F., and are not used continuously above 170° F.

The brittleness temperature of HT polyethylenes, in many cases, is considerably lower than the brittleness temperature of standard LT polyethylenes. This opens an entirely new field for low-temperature use.

Vapor transmission rates and gas transmission rates in high-tensile polyethylene are about ⅛ the comparable rates in LT polyethylene. This particular factor should be of considerable interest to packaging and container manufacturers who have had difficulty with liquid losses through permeable polyethylene films and containers.



Tensile test on welded HT polyethylene; weld is just below drawn section

The burst strength of HT polyethylene pipe is from three to four times as great as that of the same size pipe in LT polyethylene, and this burst strength improvement is maintained as the temperature is elevated. The deformation of HT polyethylene under light and moderate loading is negligible. Under loadings in the range of 1500 p.s.i. and upward, HT polyethylene still exhibits about three times as much resistance to deformation as does LT polyethylene.

The stress-crack resistance of the new HT polyethylene is much better than that for standard polyethylene.

Electrical properties are about equal to those of standard polyethylene.

Chemical resistance is as good, if not superior, to that of LT polyethylene.

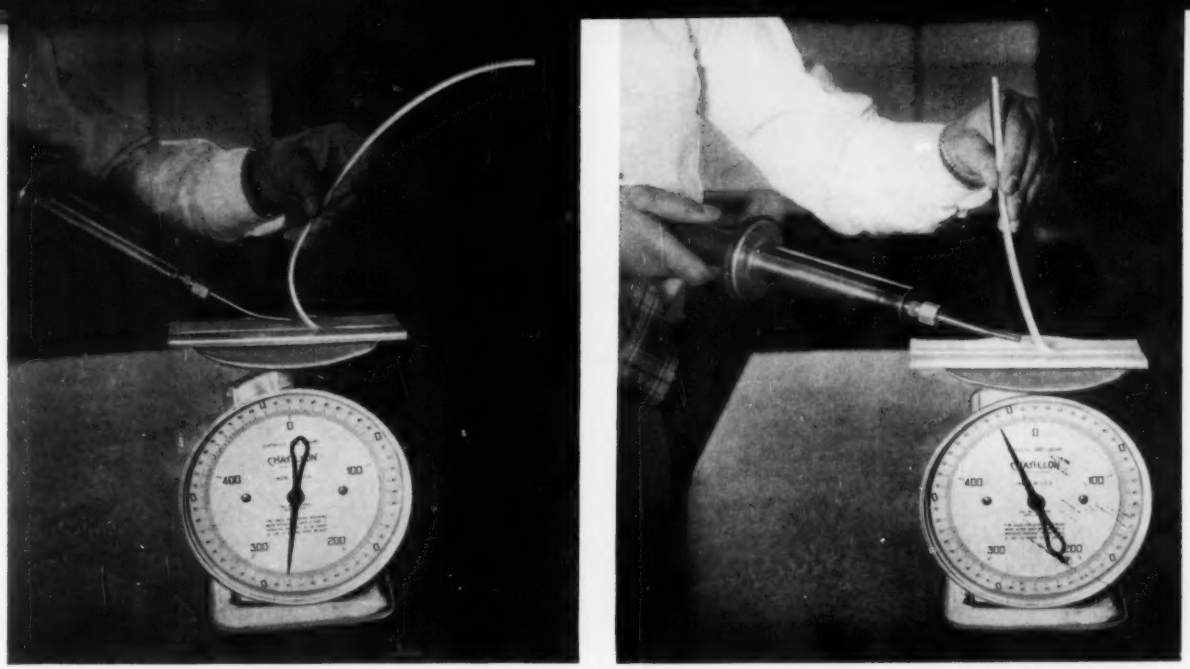
The hardness of HT polyethylene is in the range of 65 to 70 on the Shore D scale as compared with about 48 for the LT polyethylenes. The specific gravity of the HT material varies from 0.93 to 0.97 as compared with 0.92 for the LT polyethylenes.

Fabrication Methods

A necessity for any practical construction material is ease of fabrication. HT polyethylene fulfills this requirement to a much greater degree than one might expect, based on its physical properties. HT polyethylene molds and extrudes beautifully. Only slight modifications are required to produce smooth and hard surface finishes. The surface of molded HT items is not quite as waxy in appearance as the surface of LT polyethylene articles.

With minor equipment changes, HT polyethylenes can be centrifugally cast in any diameter and wall thickness desired, an important factor in producing many of the basic components used in welding of complex structures. The structural rigidity of HT polyethylene tubes is outstanding.

Most important of all, HT polyethylene can be successfully welded with high weld strength, exceeding



Comparison of welding pressures required for high- and low-tensile polyethylene. The HT material is in the photo at right. Note the increased stiffness in the welding rod. HT polyethylene can be welded with high weld strength, exceeding in some cases 100 percent

80% in practically all cases.[3,4] In exceptional cases, the weld strength may exceed 100% of the parent-material strength. The first high-tensile steels of 30 years ago, in contrast, were limited in application because of their poor weldability. A period of about five years was required to develop proper welding techniques. Because of the excellent weldability of HT polyethylenes, however, this welding-development period has been obviated. With some of the HT polyethylenes, slight modifications are required in composition of welding rod in order to achieve maximum weld strength and the filler-rod pressure used in welding must be greater for HT polyethylene than for LT polyethylene. Unlimited possibilities are represented by the welding of various basic components such as sheet, centrifugally cast tubes, rods, and pipe.

HT polyethylene sheet can be easily formed into various shapes to produce rigid self-supporting items such as scoops, tanks, covers, and trays.

With some technique modification, HT polyethylene can be powder-sprayed or floc-coated to produce uniform surface coatings having excellent impact and chemical resistance. In addition, these coatings have much better temperature-resistance characteristics than standard LT polyethylene coatings.

[3] "Hot Gas Welding," J. A. Neumann, MODERN PLASTICS *28*, 97 (Nov. 1950).
[4] "Manual for Plastic Welding II," J. A. Neumann and G. Haim, Industrial Book Co., Cleveland, Ohio (1954)

Application Potential

The property improvements represented by the development of HT polyethylenes open the door to new and improved applications. Self-supporting polyethylene structures can be fabricated in thinner yet stronger sections than possible with LT polyethylenes. In meeting the same strength requirements, fabrications in HT polyethylenes can be ½ the weight of comparable LT polyethylene fabrications. Lightweight structures can be produced having the same strength as other rigid thermoplastics with the additional factors of high impact strength and excellent chemical resistance.

This high strength/weight ratio of HT polyethylenes will prove important in the fabrication of ducting, centrifugal blowers, stacks, hoods, and other ventilating equipment. The use of HT polyethylene in fan and blower rotors and housings will provide a material with increased abrasion resistance, high impact resistance, and a greatly decreased tendency to creep.

Sturdy functional tanks and other process vessels can be easily fabricated with HT polyethylene. Self-supporting structures will, in many cases, replace linings which were formerly the most economical method of providing complete corrosion protection. Self-supporting HT tanks are high in both tensile and impact strength and have excellent temperature characteristics. The increased temperature resistance of HT polyethylene and its strength at higher temperatures will allow these vessels to be used in continuous contact with boiling aqueous solutions at confining pressures as great as 20 p.s.i. Yet, there will be none of the disadvantages

Sturdy, rigid hand scoop is formed from ⅛ in. thick HT polyethylene

usually associated with tank linings; for example, the problem of differential expansion coefficient between the liner and the supporting tank.

Scrubbers used in the chemical industry can be conveniently fabricated in large diameters to handle solutions and gases at temperatures up to 250° F. This represents a tremendous increase in the upper temperature limits of presently available thermoplastic equipment.

Steam up to 20 p.s.i. gage pressure can be readily tolerated without appreciable dimensional variation in HT polyethylene. This means that much of the equipment used in food processing plants which requires steam sterilization can now be fabricated in HT polyethylene. Included are such items as kettles, mixing tanks, food trays, pipe lines, valves, and certain cookers.

The ability to sterilize under steam pressure will open a new field in hospital equipment of various types. Equipment fabricated in HT polyethylene can be handled along with other hospital equipment and sterilized under the same cycle. Yet this equipment will be free from breakage hazards commonly encountered with glass and will be light in weight in comparison with comparable metal units. Analytical equipment for laboratories can be dried in standard lab ovens at 105 to 110° C.

Even though polyethylene has an inherently low thermal conductivity, it is frequently used in the construction of heat exchangers for handling very corrosive materials. High graphite loadings are sometimes used to improve heat-transfer properties. The extension of the upper and lower use temperatures of HT polyethylene means that it will be available for an even greater variety of heat exchanging and cooling applications, from a lower limit of about —190° F. to a maximum temperature of 260° F.

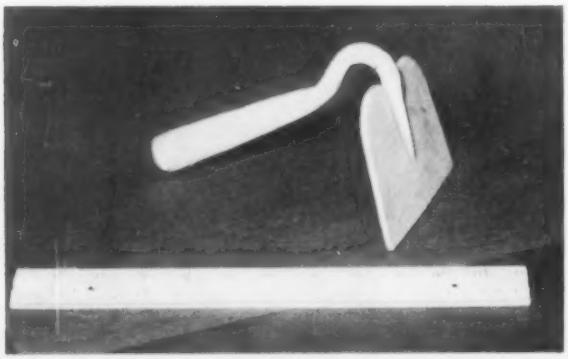
Many electrical applications at higher temperatures demand a rigid plastic having excellent dielectric properties. HT polyethylene may prove to be the material.

One-piece moldings in LT polyethylene have been made in surprising sizes. Moldings weighing 500 lb. are not uncommon. Preliminary evaluation with HT polyethylene indicates that it can also be molded in large-size units. This means that one-piece tanks and kettles can be fabricated in standard sizes. These vessels have no welded joints. They are rigid, have high-impact strength, are chemically resistant, and have good heat resistance.

Effects of Irradiation

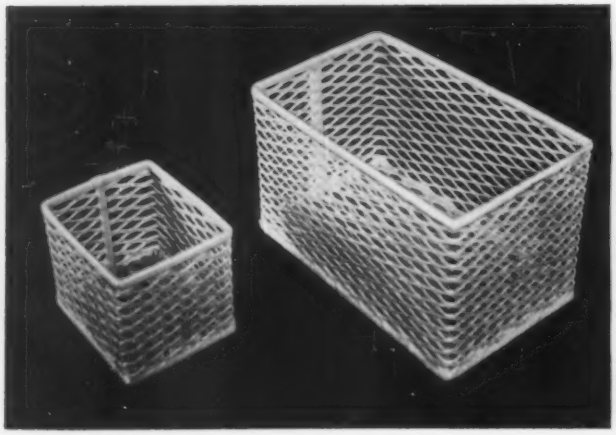
What is to happen in the field of irradiated polyethylene? The new HT polyethylenes seem to possess all of the desirable properties produced by high-energy irradiation of LT polyethylenes. It must be emphasized, however, that the HT polyethylenes do not eliminate the need for irradiation but rather that they extend the range of base materials applicable for irradiation. Irradiation of high-tensile polyethylene produces still better properties in these materials. In a manner similar to low-tensile polyethylene, HT polyethylenes are cross-linked and become elastic above the melting point.

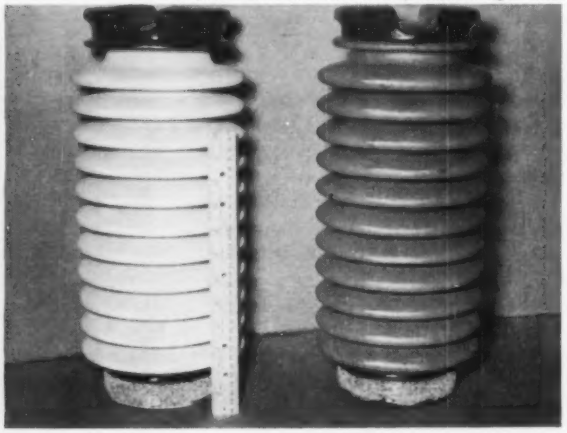
The elasticity at temperatures above the melting point opens a vast field in vacuum forming of HT polyethylenes. Much deeper draws will be possible with irradiated high-

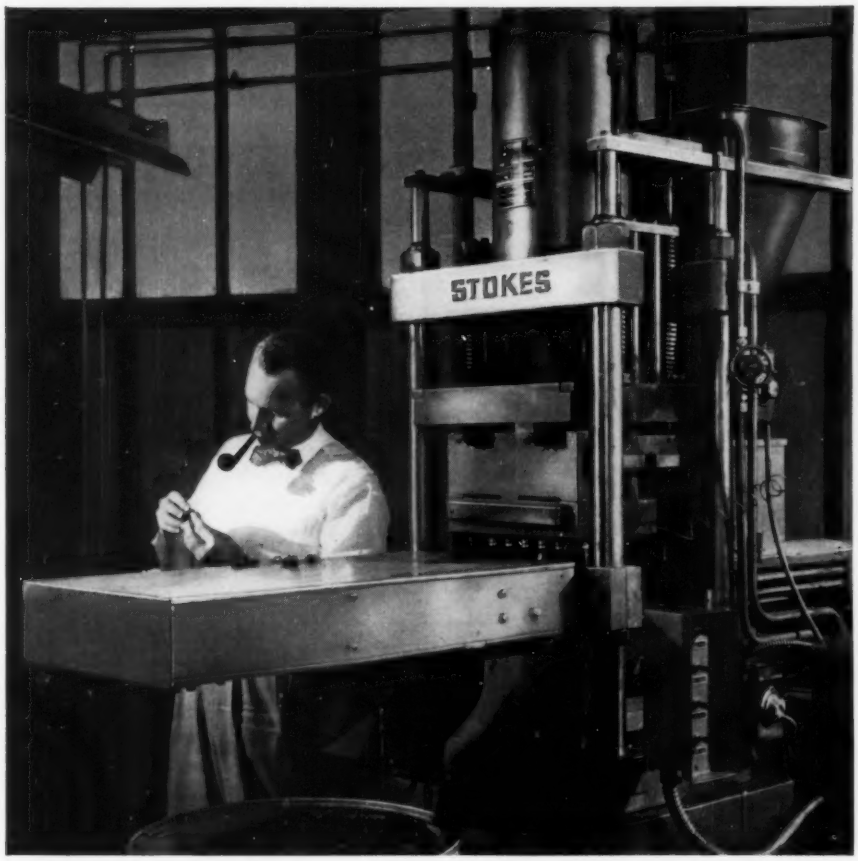


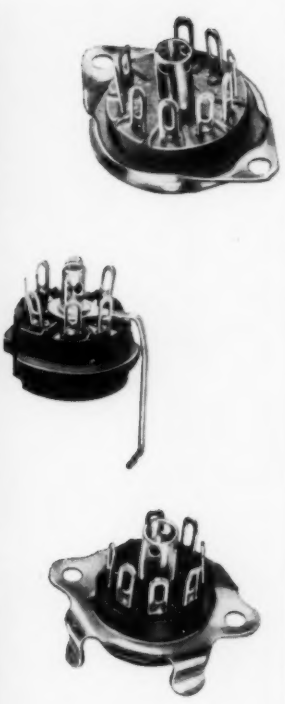
Several products coated with HT polyethylene. At left is a hoe head, powder-sprayed with high-tensile polyethylene, for manual handling of hot corrosive solids; at bottom left are dipping baskets, floc-coated with HT polyethylene, for use at elevated temperatures; at bottom right are electrical insulators, floc-coated with HT polyethylene powder for high-temperature resistance

All photos with this article courtesy American Agile Corp.









This Model 741 Stokes automatic molding press operates 24 hours a day, Saturdays and Sundays included, at Mandex Manufacturing Company, Chicago. Typical sockets of general-purpose black and mica-filled phenolic are shown above.

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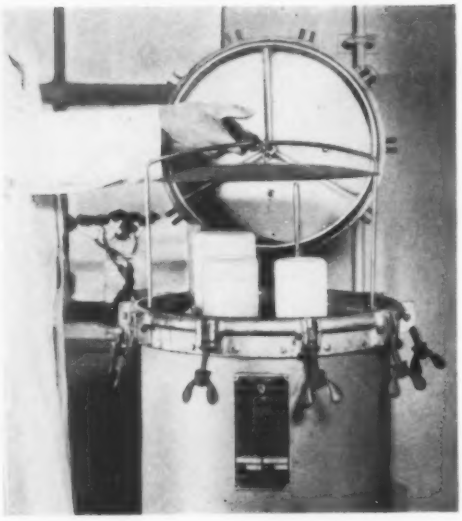
Scrubbers for handling hydrofluoric acid fumes are fabricated of HT polyethylene in large diameters to operate at temperatures up to 250° F.



Autoclave sterilization of HT polyethylene beakers at 20 p.s.i.g. Beakers maintain their good rigidity characteristics under autoclave pressures and temperatures

Laboratory equipment produced of HT polyethylene can be dried in standard ovens at 105 to 110° C. HT polyethylene equipment is not affected by these temperatures and, unlike laboratory glassware, poses no breakage problem

tensile polyethylene than with non-irradiated high-tensile polyethylene. In addition, there are definite mechanical property improvements.

Even though the HT polyethylenes are extremely resistant to stress cracking, they are still not totally free from this annoying phenomenon. Irradiation in proper doses produces a material which is completely free from stress-crack attack.

In general, the doses required to bring about a specific property improvement in HT polyethylenes are less than those required to bring about the same degree of improvement in LT polyethylene.

On the other hand, there are demands for irradiated LT polyethylene which the HT materials cannot satisfy even when irradiated. These involve certain uses in which highly flexible units are to be irradiated. Just as it is true that HT polyethylene will not displace LT polyethylene, irradiated HT polyethylene will not displace irradiated LT polyethylene. They will mutually complement the range of available materials to the consumer.

Conclusion

The recent development of high-tensile, high-temperature polyethylenes introduces a completely new concept in plastic materials of construction. It brings to the fabricator a material having high rigidity, good temperature resistance, high impact strength, and extremely good chemical resistance. The HT polyethylenes can replace many of today's more expensive materials and the resulting products will be lower in initial cost and need less maintenance.

A major factor in the utilization of HT polyethylenes is their excellent weldability, which allows the fabrication of structures and equipment limited only by the imagination.

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Unusual Mold Design Produces

Precision Moldings

by RUDOLPH LORENZ, JR.*

SLOTTED pressure plates are used in certain IBM punched card machines to guide the electrical brushes which "read" the holes in the cards. Because of the close tolerances required, the plates were originally designed to be machined from 61S aluminum flat stock (Fig. 1). Twenty-eight separate machining operations were required, followed by three coats of insulating varnish.

In an effort to reduce manufacturing costs, the part was later redesigned for plastics molding, as in Fig. 2. The most important change was dividing the plate into two duplicate halves.

Functional requirements dictated a material with good electrical properties, wear resistance, and moldability, coupled with excellent dimensional stability. A styrene copolymer was chosen.

Although the mold was built on an experimental basis, it was designed to be suitable for a production of 4000 moldings per year. This quantity was low enough to make a single-cavity mold practical. An 8-oz. injection machine of the horizontal-injection, vertical-clamp type was selected in preference to a horizontally split machine, thus permitting the cavity to be centered in the mold base instead of locating it on one side because of the necessity of side gating the molded part.

Ejection Requirements

A check of ejection requirements showed a very unfavorable condition. The contact area of the molding is approximately 56 sq. in., compared to a projected area of 15.3 sq. inches. Because of this high ratio of sticking area to projected area, it would be extremely optimistic to hope to force the part from the cavity with ejector pins, which of necessity would be limited to 0.030-in. diameter and, therefore, be subject to frequent breakage. It was decided that the only recourse was to retract the blade assembly which produces the slots in the molding, thus leaving the part lying unrestricted in the cavity for easy removal.

The completed mold is shown in Figs. 3, 4, and 5. The cavity is laminated to permit retraction; in effect, it is made up of 81 blades. Instead of retracting the "slot" blades, however, the 41 bottom blades are forced up between the slot blades to strip the molding. Each set of blades is clamped in notched "comb" bars. As shown in Figs. 6 and 7, the comb bars anchor the slot blades to the lower cavity and anchor the bottom blades to the floating cavity plate. This plate is guided by four ¾-in. diameter pins, thus assuring uniform ejection pressure on all portions of the molded part.

Ease of Repair

As the mold opens, the pins forming the 0.152-in. diameter holes are carried up with the upper half of the

Fig. 1 (right)—Original pressure plate with 80 close-tolerance slots was machined from flat aluminum stock, heavily varnished for electrical insulation

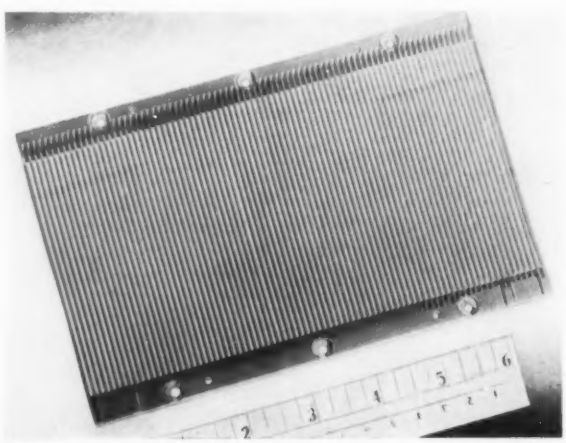
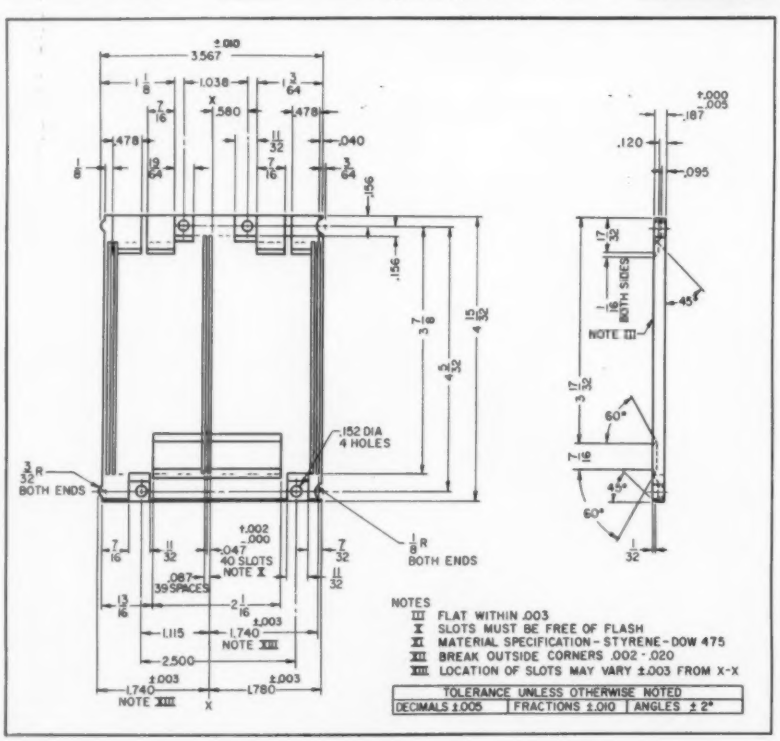


Fig. 2 (below)—Engineering drawing of pressure plate as it appears redesigned for plastics molding



*Associate Engineer, Endicott Engineering Plastics Laboratory, International Business Machines Corp.

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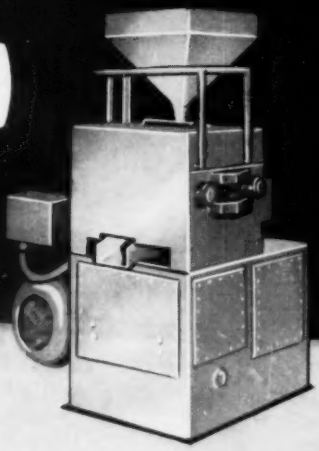

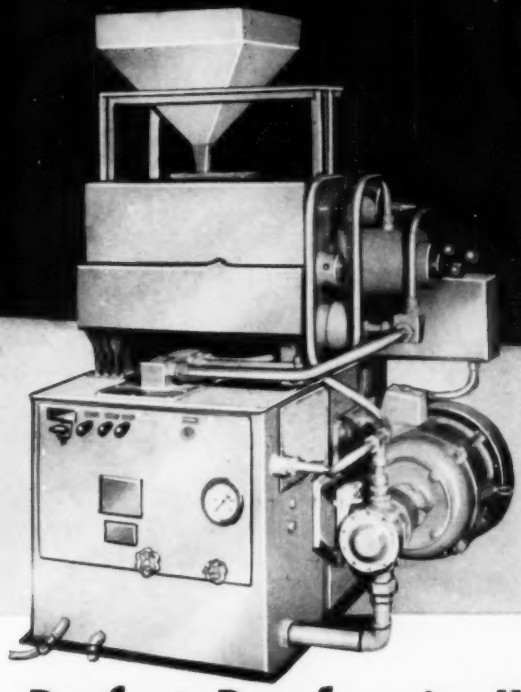

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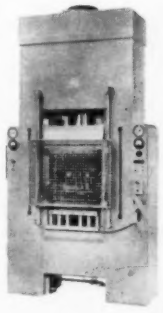

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Milwaukee Plastics, Inc.	Milwaukee, Wisc.
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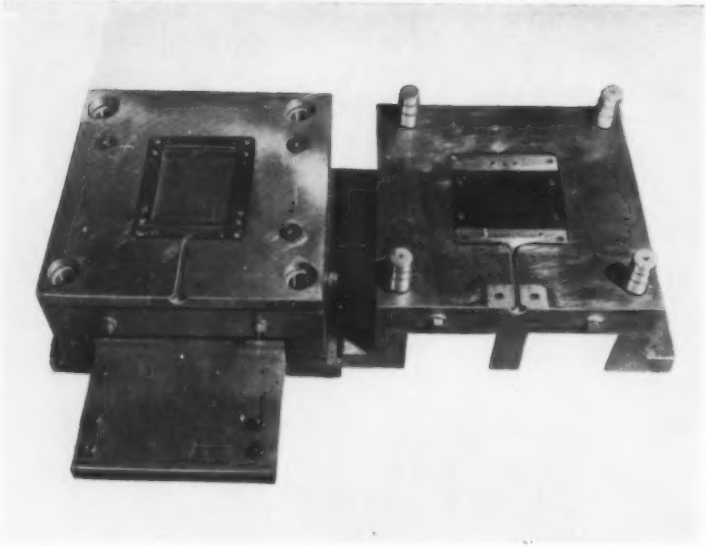


Fig. 3—Complete mold; lower half at left shows ejector slide

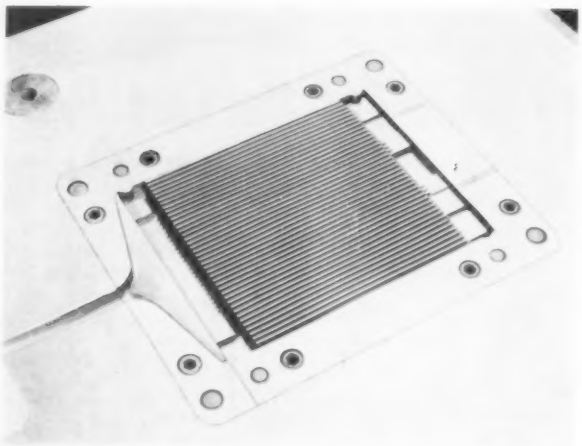


Fig. 4—Close-up of lower half of mold for plastic pressure plate, showing slot blades protruding in normal molding position

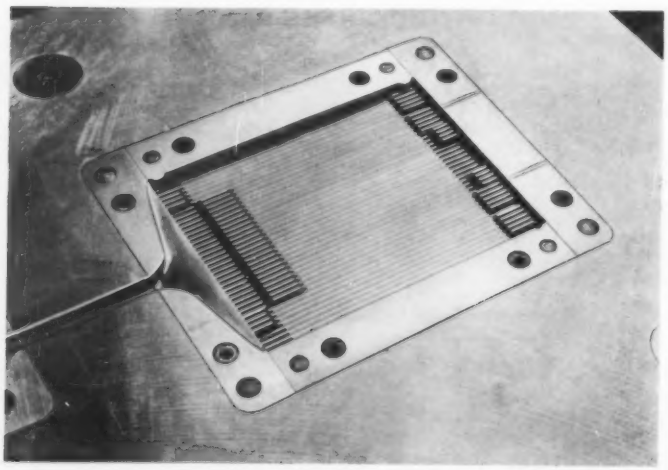


Fig. 5—Lower mold half in ejection position; slot and bottom blades are flush

mold. The bottom blades then move up ¼ in. to strip the part from the "slot" bars. The part is left lying in the lower cavity, and the natural shrinkage of the plastic permits it to be removed with little difficulty. An incidental but very useful advantage of lamination is the ease of repair in the event of an accident to the mold.

A study was made of the forces acting on the floating cavity plate during ejection. These forces consist of: 1) the friction between the plate and its guides, 2) the friction between the mold and the part, and 3) the vacuum pockets formed between the mold and the part. Base figures were established for the coefficient of friction between steel and steel, and between steel and styrene. The force due to the retarding of shrinkage was established. These known forces totalled 1500 pounds.

The effect of this load on the floating cavity plate was checked next. A deflection of 0.001 in. was determined to be the maximum that would not affect the sliding fits necessary for reliable operation. Calculation of the force necessary to deflect the plate 0.001 in. gave a value of 2800 pounds. Since this was considerably higher than the 1500 lb. previously determined, the floating cavity plate was shown to be entirely adequate as designed.

In order to assure free sliding of the 41 bottom blades, they were relieved as seen in Fig. 6. Tolerances were governed by the tolerances of the slots in the molded part, by the fits required for sliding action, and by the danger of binding due to unequal thermal expansion of the different parts of the mold.

Mold Part Treatment

To insure stress-free parts and maximum dimensional stability, the blades forming the cavity received seven heat-treating operations. Raw material was an oil-hardening, nondeforming gage stock. After rough machining, the blades were hardened at 1450° F. and quenched in oil. A sub-zero chill at −80° F. followed; then the blades were tempered to Rockwell 58 C. At this point, the blades were rough-ground.

After rough grinding, the blades were chilled to −80° F. and reheated to 450° F., the tempering temperature. This cycle was repeated three times. Finally, the blades were fin-

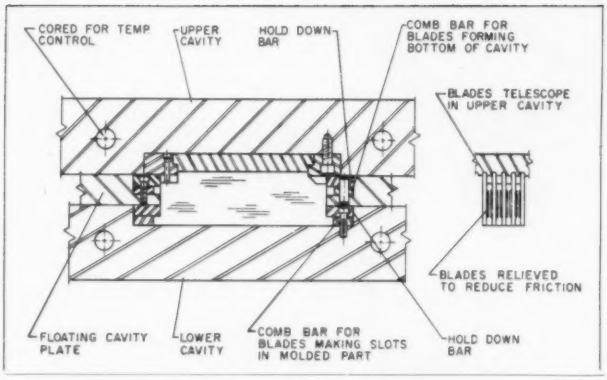

CORED FOR TEMP. CONTROL
UPPER CAVITY
HOLD DOWN BAR
COMB BAR FOR BLADES FORMING BOTTOM OF CAVITY
BLADES TELESCOPE IN UPPER CAVITY
BLADES RELIEVED TO REDUCE FRICTION
FLOATING CAVITY PLATE
LOWER CAVITY
COMB BAR FOR BLADES MAKING SLOTS IN MOLDED PART
HOLD DOWN BAR

Fig. 6—Cross-sectional diagram of mold when closed

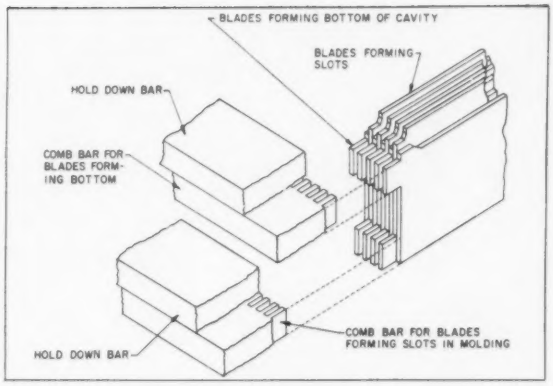
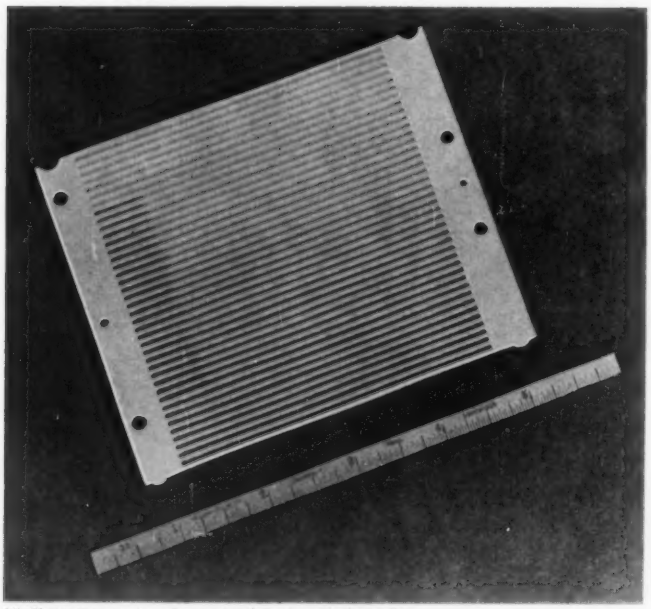

BLADES FORMING BOTTOM OF CAVITY
BLADES FORMING SLOTS
HOLD DOWN BAR
COMB BAR FOR BLADES FORMING BOTTOM
HOLD DOWN BAR
COMB BAR FOR BLADES FORMING SLOTS IN MOLDING

Fig. 7—Detail showing blade actuation



All illustrations courtesy International Business Machines Corp.

Fig. 8—Finished pressure plate molding

ish-ground and lapped in the direction of movement to a tolerance of ±0.0001 inch.

The comb bars were made from annealed SAE 4140 steel. Tolerances specified were ±0.0001 in. on slot width and ±0.0002 in. on slot location. An attempt was made to rough-machine the slots and then finish-grind after hardening. It was found that grinding one side of a slot at a time resulted in extreme deflection of the grinding wheel. Dressing the grinding wheel to the full width of the slot and grinding both sides at once was equally unsuccessful because the position of the slots moved during hardening and the grinding wheel was still deflected beyond tolerance. Finish-grinding from the solid solved the problem.

Still another consideration in regard to the slots in the molded part was the flash problem. The punched cards pass over the pressure plate at a rate of 150 cards per minute. To prevent feed jams, there must be no flash, protrusions, or edges on the molding. The problem was solved by telescoping the slot blades into the upper half of the mold. This prevents flash from forming over the top of the slots. Rather, any flash that does form projects vertically, where it is easily removed by belt sanding. Telescoping the blades also gives rigid support to the slot blades and helps assure precision moldings.

A full round (¼-in. diameter) runner was specified, feeding into a fan gate to give easy flow to all portions of the cavity. A cold slug well was not provided because experience indicated that careful operating techniques should make the well unnecessary. Subsequent molding of the part confirmed this expectation. The design shrinkage allowance for the mold was 0.004 in. per inch.

Ejector Mechanism

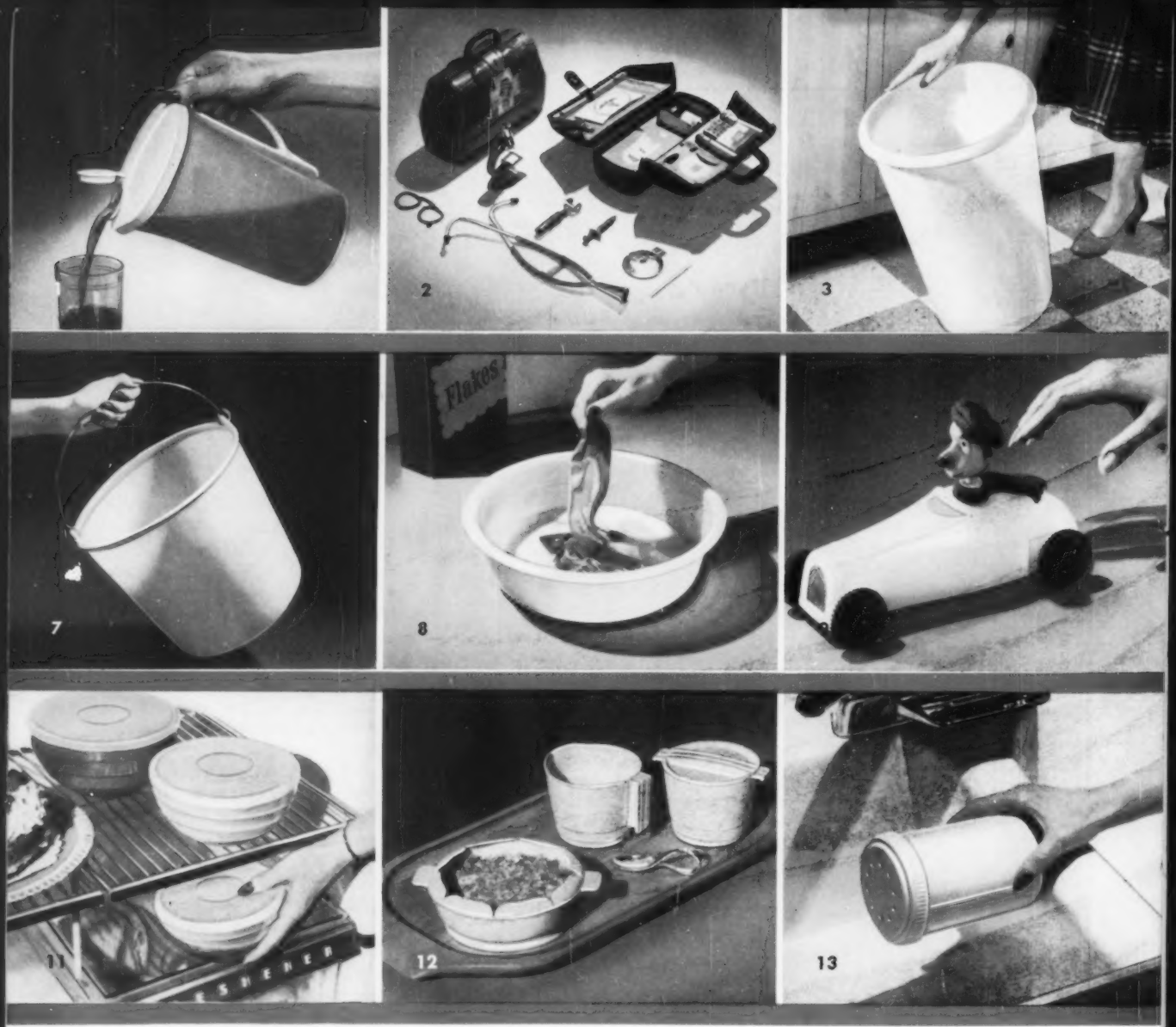
In setting up the mold in press, extreme care is used in adjusting the ejector mechanism. It is essential that the floating cavity plate be raised evenly; otherwise the 41 bottom blades will be thrown out of line, with possible severe damage to the mold.

A number of shots were made under different conditions of pressure, temperature, and cycle time. The following conditions were found to yield parts conforming fully to print specifications (Figs. 2 and 8).

Cylinder temperatures	
Hopper end	390° F.
Center band	390° F.
Nozzle	370° F.
Molding pressure	850 p.s.i. on 12-in. ram
Clamp	300 tons
Mold temperature	100 to 110° F.
Closing time	15 sec.
Forward dwell	Hold 25 sec.

Quotations based on the new mold indicate that the cost of the finished two-piece molded pressure plate will be 4% of the cost of the original machined aluminum plate.

It is concluded that extreme-accuracy moldings can be obtained in production if due attention is paid to five basic factors: ejection, quality mold construction, appropriate molding pressures and temperatures, flash removal, and careful molding techniques.



1. Juice Pitcher—Flambeau Plastics Corp., Baraboo, Wis. **2. Doctor and Nurse Play Kits**—Transogram Co., Inc., N. Y. 10, N. Y. **3. Wastebasket**—Plas-Tex Corp., Los Angeles 64, Calif. **4. Play Dishwashing Set**—Kiddie Brush & Toy Co., Jonesville, Mich. **5. Vegetable Crisper and Drain Tray**—Rona Plastic Corp., New York 61, N. Y. **6. Dish Pan**—Beacon Plastics Corp., Newton Highlands 61, Mass. **7. Pail**—Columbus Plastic Products, Inc., Columbus, Ohio. **8. Wash Basin**—Alladin Plastics Inc., Los Angeles 45, Calif. **9. Self-Return Toy**—Tigrett Industries, Chicago 11, Ill. **10. Toy Train**—Processed Plastic Co., Aurora, Ill. Molded by Han-Win Products Co., Aurora, Ill. **11. Bowl Set. 12. Toddler's Cereal Bowl plus Sugar Bowl and Creamer. 13. Cleanser Container**—Plastray Corp., Detroit 2, Mich. **14. Drain Tray**—Alladin Plastics, Inc., Los Angeles 45, Calif.

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To all these physical properties, Tenite Polyethylene adds the many advantages of spherical pellet form. Spherical pellets insure better flow and reduced "bridging" during molding. Their smooth, unbroken surfaces provide no place for dust to settle in. Their lower bulk saves up to 10% in shipping or storing space. And, because there are fewer "fines," molders can clean hoppers quickly when changing colors. In addition, Tenite Polyethylene gives you unmatched color quality, good color dispersion and a finish that is amazingly glossy for Polyethylene—one that approaches the smooth, lustrous surfaces obtained with plastics of much greater inherent hardness.

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POLYETHYLENE APPLICATIONS INCLUDE packaging film . . . molded products . . . wire and cable insulation . . . pipe and tubing . . . bottles . . . paper coatings.

Fig. 1—Top half of drop hammer will be cast on bottom half, surrounded by plaster wall

Fig. 2—Epoxy resin and catalyst for die are carefully weighed out

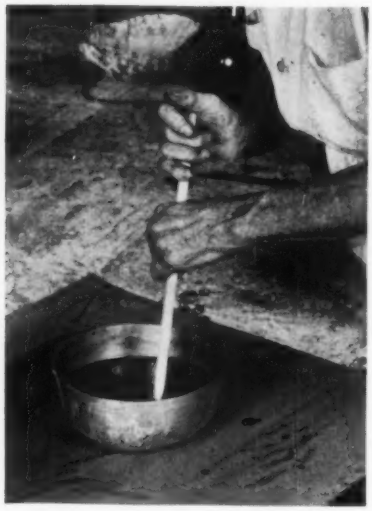

Fig. 3—Resin-catalyst mixture is stirred manually for about 10 minutes

Drop Hammer Dies

Cast solid epoxy and epoxy-surfaced dies for forming sheet metal save time and labor costs, eliminate finishing operations

CAST from epoxy resins, drop hammer dies have shown cost savings as great as 50% over previously used Kirksite and lead tools, according to reports from the Teicher Mfg. Co., Flushing, N. Y. The dies are being used in the production of metal stampings for aircraft components and other products. The epoxy resin is produced by The Marblette Corp., Long Island City, N. Y.

Because of the variegated nature of the Teicher operation, different materials and combinations of materials are employed in producing the dies. On drop hammer presses, for instance, the weight of the punch is a controlling factor, and a punch made of metal plus plastic is needed for sufficient heaviness. On power presses, such as the Braintree press or the Ceco stamp, all-plastic hammer dies are practicable because weight is not always necessary but sometimes, as in the case below, can be used to advantage.

Drop Hammer Die

A typical tooling job which has been simplified and made more economical by the use of epoxy resins is one involving the production of dies for forming blanks of 0.064 in. thick aluminum on the Ceco stamp. Depending on the contours desired, similar dies would be equally effective in stamping various thicknesses of such other sheet metals as cold-rolled steel, stainless steel, or black iron.

To produce the solid aluminum-filled epoxy bottom half of the die, a plaster mold is first made from loftings or a fabricated part. Since there is no appreciable shrinkage in the finished casting, there is no need for an oversized plaster mold. The plaster mold is fitted with a retaining wall high enough to allow 4 in. from the apex of the highest contour of the mold to the top edge of the wall.

Marblette No. 614 aluminum-filled epoxy resin is then poured into the plaster mold and the mold is placed into a baking oven where the epoxy

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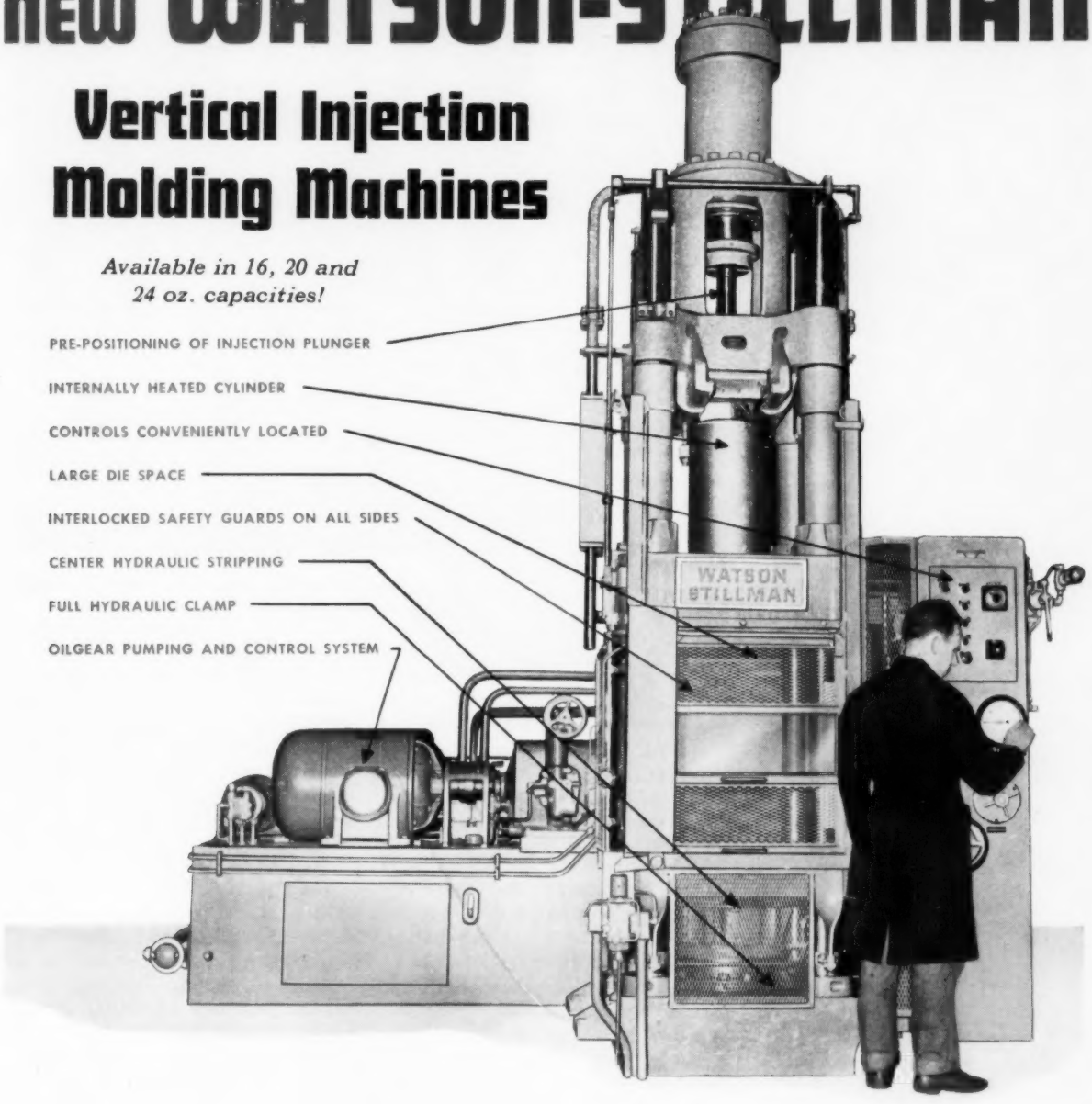

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All photos with this article courtesy The Marblette Corp.

Fig. 4—Predetermined amount of epoxy resin mixture is poured over release-agent-covered mold held in retaining wall (see Fig. 1)

Fig. 5—Lead block on which epoxy face will be cast is suspended above die. Steel pins will be used to bolt punch to press

Fig. 6—Epoxy die (bottom) and epoxy-faced lead punch (top) are inspected in press

is cured for 2 hr. at 200° F. and 3 hr. at 350° F.

If setting at room temperatures is required, Marblette No. 610 epoxy resin is used. This resin, however, can only be surface cast up to 1 in. in thickness as a facing for a lead or Kirksite block.

Casting the Punch

The cured bottom half of the die is used as a mold for casting the top half, or punch, of the die. A retaining plaster wall is first built up around the bottom half of the die (Fig. 1), which has been coated with a parting agent such as Vibrin (VPA solution supplied by Naugatuck Chemical Co.).

Marblette No. 618 epoxy resin, a resilient material, and Marblette No. 684 catalyst, which was developed especially for this epoxy compound, are used in casting the punch. While resins that set at room temperatures could be substituted for an oven-curing resin such as No. 618, the use of No. 618 is warranted because of the added strength it imparts to the finished casting. The inherent resiliency of the resin also eliminates the need for scraping the finished punch to allow for the thickness (up to 0.070 in.) of the sheet metal being formed.

After the resin and hardener have been carefully measured out and weighed (Fig. 2), they are blended together and mixed manually for about 10 minutes (Fig. 3). Mixing can also be done by machine—such as a Hobart mixer—at slow speeds ranging from 30 to 60 r.p.m.

Since epoxy No. 618 is a surface-casting resin, a core is necessary. Although heaviness is not a critical factor for a punch on the Ceco stamp, as previously pointed out, it was decided that the core to be used for this particular application should consist of a rectangular block of lead.

A predetermined amount of the resin-accelerator blend is poured into the mold formed by the bottom half of the die and the surrounding plaster retaining walls (Fig. 4). The lead block is then suspended in the resin about ¾ in. above the top surface of the bottom half casting (Fig. 5) and the entire set-up is placed in an oven for a 4-hr. cure at 160° F. (This temperature permits the use of a lay-up of wax between bottom half and punch when dies for forming sheet metals over 0.070 in. thick are being produced.) A more usual method of producing the punch would be to first suspend the lead block over the bottom half cast-

(*To page* 137)

no wrong numbers here . . .

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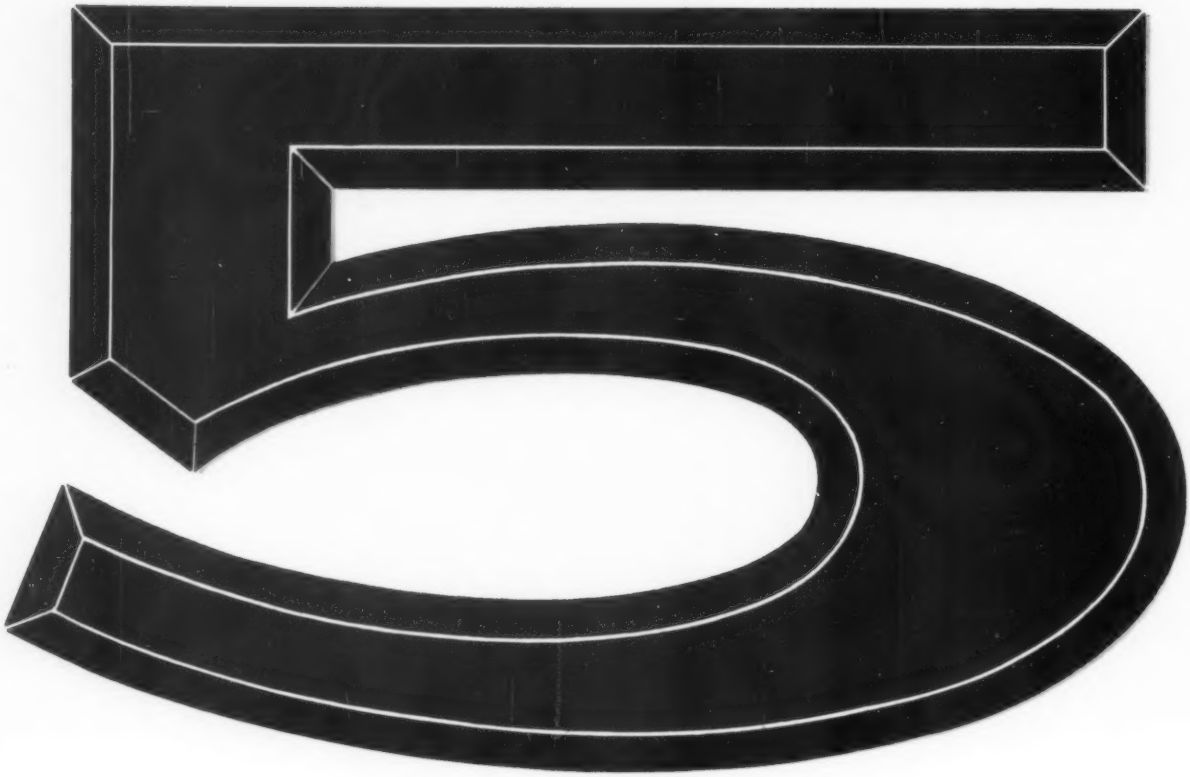

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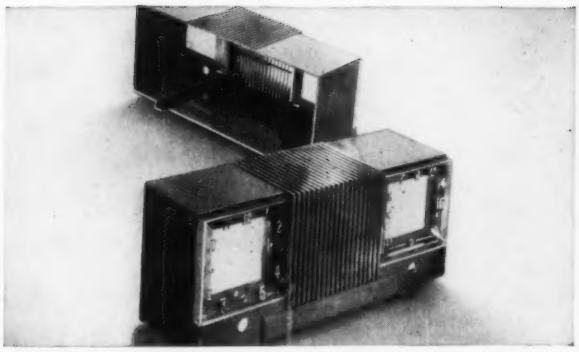
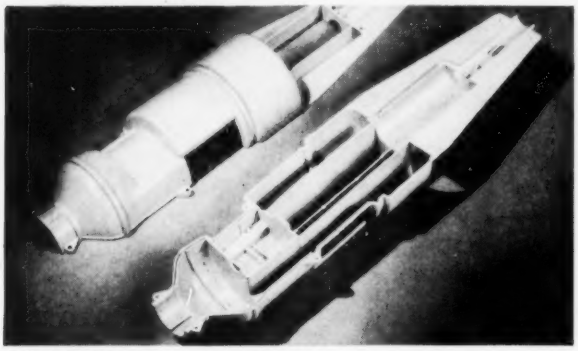
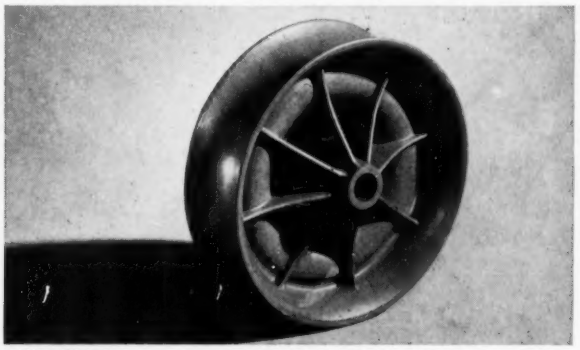


SMD-3000—the BAKELITE Styrene Plastic with a high heat distortion point of 197 deg. F. measured on an unannealed test bar ¼ in. thick. Offers reduction in molding pressures, better mold release, faster cycles. Has same color and clarity as other BAKELITE Styrene molding materials. Warping and distortion were completely eliminated in molding these radio cabinets from SMD-3000. They showed no stress-crazing even after immersion in n-heptane. Notice fine details, glossy surfaces in these front and rear views.

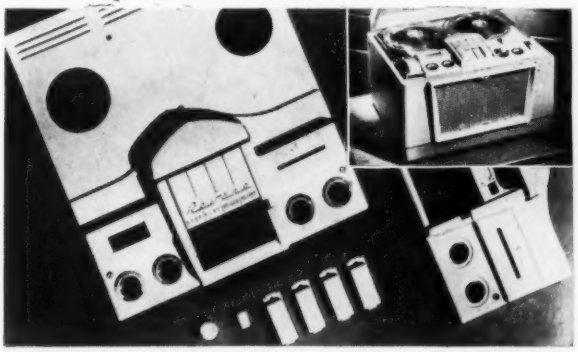
SMD-3500—BAKELITE General-Purpose Styrene. Noted for its combination of high plasticity and fast set-up. One manufacturer reported a 50 per cent decrease in molding cycle time plus complete elimination of sink marks. Another manufacturer was able to reduce cylinder temperature by 50 deg. F. while gaining a faster molding cycle. SMD-3500 flows more easily at conventional molding temperatures. It is equally serviceable for the big crisper drawer and the close-fitting syringe holder parts shown here.



TMD-5151—BAKELITE High-Impact Styrene. Has over eight times the impact strength of general-purpose styrenes. (ASTM average Izod test values using notched ⅛ in. bar at 74 deg. F.). Inherently high plasticity results in fastest set-up speed available with a high-impact styrene. Surface gloss is outstanding. Opaque color range is unlimited. Colors can be duplicated from blend to blend. Construction of these toy vacuum cleaner parts shows intricate details possible with TMD-5151.



TMD-2155—BAKELITE Extra-High Impact Styrene. Has an impact strength about eighteen times that of general-purpose styrenes. (ASTM average Izod test values using notched ⅛ in. bar at 74 deg. F.). Stays tough down to −13 deg. F. Has high heat distortion point, superior surface gloss, and excellent color. Economy, color, and strength are features of this lawn mower wheel molded of TMD-2155.



C-11 Plastic—An Acrylonitrile-Styrene copolymer that combines toughness with rigidity, color and gloss. Its chemical resistance fits C-11 for kitchen wares, food packaging, refrigerator parts. It withstands food acids and oils, gasoline, moth balls, soaps, detergents, carbon tetrachloride. Will not crack or craze when exposed to substances harmful to surface of many plastics. C-11 was selected for parts of the tape recorder illustrated to provide lasting, fine appearance despite exposure to constant wear and tear.

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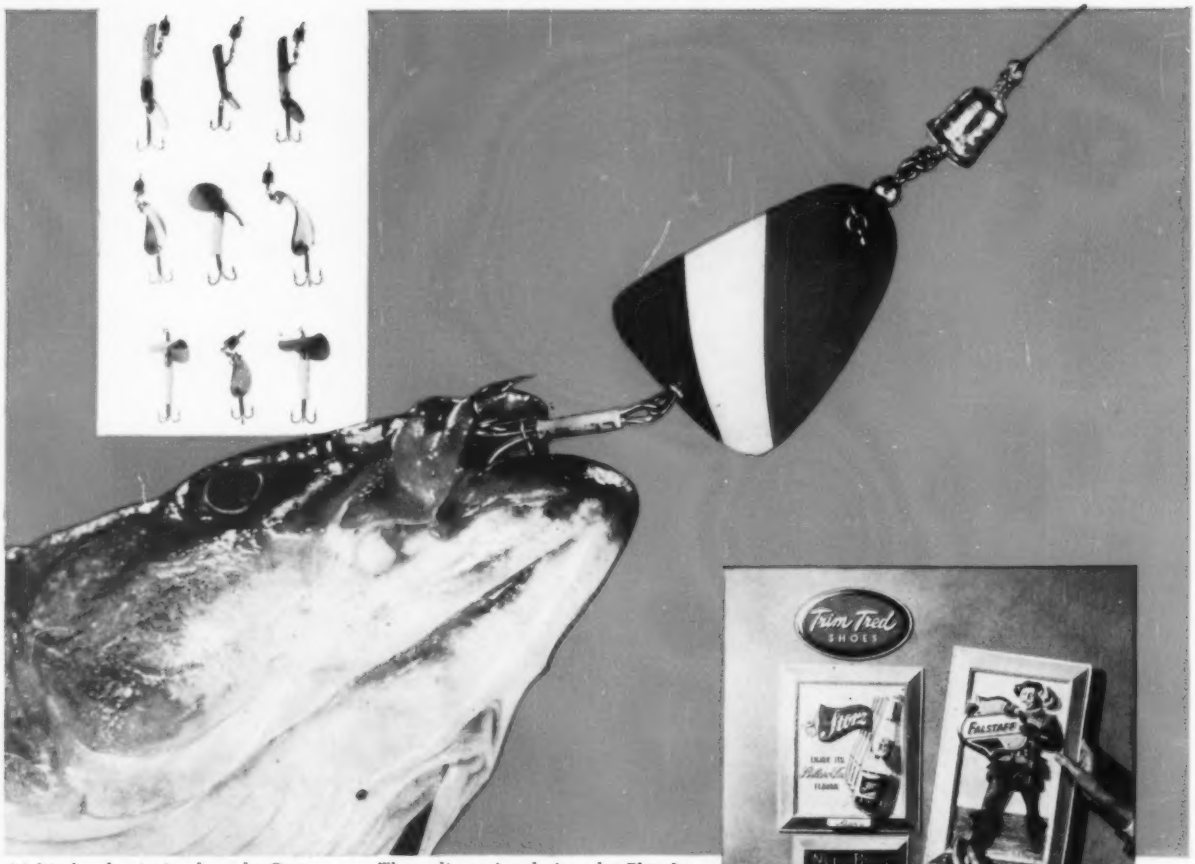

Multicolored spinning lures by **Duramark, Inc.,** Port Washington, N. Y., are color-fast, lightweight, attractive to fish in underwater action.

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ing and then pour in the resin to make the facing.

After removal from the oven, separation of the bottom half of the die and the punch is facilitated by the action of the parting agent with which the bottom half has previously been coated. As soon as the plaster retaining walls are taken down, the drop hammer is ready for operation.

Forming Metal Parts

Prior to using the die for forming metal parts, it is lubricated in the same manner as a lead or Kirksite die, with Albany grease or Johnson grease drawing compound.

The punch and the bottom half of the die are then installed in the Ceco stamp (Fig. 6), the sheet aluminum blank is inserted (Fig. 7), the punch comes down (Fig. 8), and the blank is stamped. After the finished aluminum part is removed from the press (Fig. 9), it is split into two identical halves.

The plastics dies have already stood up successfully for the production of over 250 metal parts. The epoxy has been found to resist wear and stress better than most other commonly used materials, according to company president, Arthur Teicher. Lead dies, for example, have been known to require repair after producing as few as 75 pieces.

The economies of the epoxy die are also reflected in the savings effected when dies have to be "renewed" as erosion occurs. An epoxy die can be made in a matter of hours, or, at the most, a few days; previously used materials required several days to weeks of work. And the 4 hr. required for epoxy refacing is also a considerable saving in time over that needed for rehabilitating a worn lead die.

The elimination of finishing operations and scraping to allow for metal thickness is another time saving advantage. In addition, in contrast to Kirksite molds whose 8% shrinkage makes oversize castings obligatory, shrinkage of epoxies is negligible, and oversize castings unnecessary.

In arriving at the estimated 50% cost savings brought about by the use of epoxy resins, it is, therefore, not the differences in material costs that create the economy, but rather large reductions in time and labor expense—with no sacrifice of production efficiency or desired results.

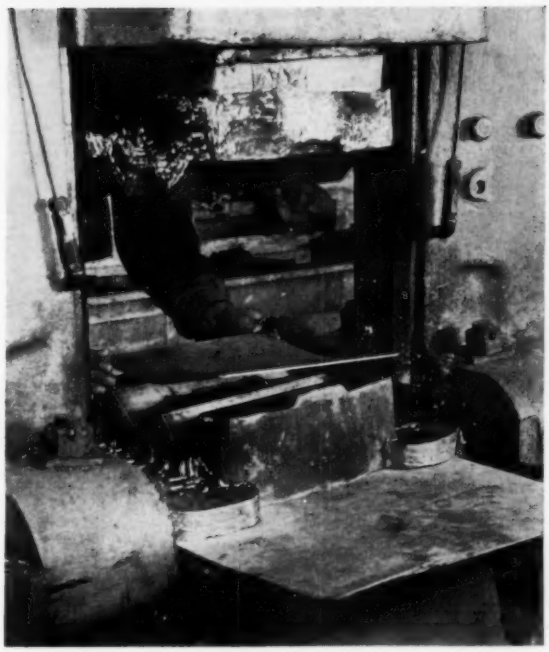

Fig. 7—Blank of 0.064-in. aluminum sheet is placed on epoxy die installed in Ceco press

Fig. 8—Epoxy-faced lead punch comes down toward aluminum blank in position atop epoxy die

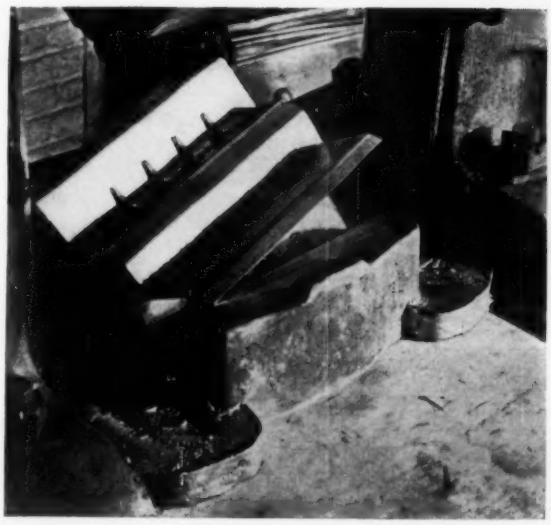

Fig. 9—After being formed by the plastic die, stamped part is ready for final fabrication

A Manual for Reinforced Plastic Tooling

prepared by

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Considerations in the Design of

PLASTICS STRUCTURES FOR LIGHT WEIGHT

by C. H. ADAMS†, W. N. FINDLEY‡, and F. D. STOCKTON§

The choices of geometry and material for a structural member are not usually independent, but are related through the functional requirements. If a sufficient number of functional and geometrical requirements are prescribed, the criterion for the selection of the optimum material for lightest structural weight is often completely determined. A method is described for deriving criteria for selecting the optimum material to satisfy service conditions. The problem of selection of material for minimum weight of a structure is examined. It is shown that the simple ratio of strength to weight (specific gravity) is not satisfactory for predicting minimum weight of a structure.

THE structural designer's problem is to specify a structure that satisfies certain functional requirements, i.e., service conditions stated in the specifications for the structure. In the physical solution of the problem the designer is free to choose any geometrical configuration for the structure and any material of construction that are consistent with the functional requirements and with each other. The functional requirements must be considered as independent variables which may partially determine the finished structure. Some of the choices of geometry and construction material are also independent variables; but generally speaking, all are not. If the geometry of the structure for a given service is chosen or prescribed, the stresses or strains, temperature, etc., on the material from which the structure is manufactured are often determined. In order to withstand the service loads, temperature, etc., certain physical properties or combinations of them are required of the material. Analogous restrictions on geometry arise if the material is chosen first.

When a structure is required to have minimum weight, the selection of the material depends not only on the type of service expected but on the type of loading (tension, bending, torsion, etc.) involved in the particular member and on the type of strength (static strength, fatigue strength, creep strength, etc.) which that member will be called upon to develop.

This problem was considered by one of the authors (1)[1] in 1947 to show that the simple ratio of strength to specific gravity was not a satisfactory parameter for selection of materials for a lightweight structure. Instead the relationship between strength σ and specific gravity S varied from the simple ratio σ/S to σ/S^2, depending on the type of loading to which the structure was subjected.

An extensive study of the design of structures for light weight, containing references to other literature on the subject, was published by Shanley (2) in 1952. The object of the present paper is to discuss the dependence of the selection of material on the functional requirements and the choice of geometry.

Functional Requirements

To simplify the present discussion, the functional requirements will be restricted to a few of those pertinent to rather special structural elements. In addition, it will be required in all cases that the member concerned be as light in weight as possible.

A functional requirement often involved is adequate resistance to some type of deformation. One of the simplest is that a tensile bar of uniform cross-section stretch elastically no more than a certain amount due to a load, P, producing a stress σ. The equation relating the deflection and the stress on the material of a tensile bar is:

$$\delta = \frac{L\sigma}{E} \qquad \text{Eq. 1}$$

in which δ is the elongation of the bar, L is the length of the bar, σ is the uniform stress in the bar, and E is the elastic modulus of the material.

A slightly different type of resistance to deformation (buckling) is required of a column. In a long slender column with pivot ends the critical average stress σ_{cr} at which buckling might commence is given by the following:

$$\sigma_{cr} = \frac{\pi^2 E}{(L/r)^2} \qquad \text{Eq. 2}$$

in which E is the modulus of elas-

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[1] Numbers in parentheses link to references at end of article p. 216.

Table I—Comparison of Weights of Structures Made of Different Materials[a]

Functional specification	Criterion for minimum weight	Order of increasing weight of structure						
		SAE X4130 steel	Titanium alloy	75 S-T aluminum alloy	Paper laminate, phenolic	Cast phenolic	Tough styrene	Crystal styrene
A. Strength								
1. Axial load	γ/σ	4 (2.83)	1 (1)	2 (1.12)	3 (1.81)	6 (5.12)	7 (9.18)	5 (4.68)
2. Bending of simple rectangular beam								
a. Width specified	$\gamma/\sigma^{1/2}$	7 (2.94)	3 (1.33)	2 (1.11)	1 (1)	5 (1.63)	6 (1.97)	4 (1.39)
b. Depth specified	γ/σ	4 (2.83)	1 (1)	2 (1.12)	3 (1.81)	6 (5.12)	7 (9.18)	5 (4.68)
3. Torsion of circular shaft	$\gamma/\tau^{2/3}$	5 (2.62)	— —	1 (1)	4 (2.04)	3 (1.39)	— —	2 (1.20)
B. Stiffness								
1. Axial load	γ/E	1 (1)	3 (1.08)	2 (1.04)	4 (2.25)	5 (7.17)	7 (10.6)	6 (10.1)
2. Bending of simple rectangular beam								
a. Width specified	$\gamma/E^{1/3}$	7 (2.40)	6 (1.70)	2 (1.22)	1 (1)	5 (1.41)	4 (1.40)	3 (1.35)
b. Depth specified	γ/E	1 (1)	3 (1.08)	2 (1.04)	4 (2.25)	5 (7.17)	7 (10.6)	6 (10.1)
3. Torsion of circular shaft	$\gamma/\tau^{2/3}$	5 (1.65)	— (1.30)	1 (1)	5 (1.66)	6 (1.77)	7 (2.24)	3 (1.62)
C. Resistance to impact Bending of simple rectangular beam	$\gamma E/\sigma^2$	7 (8.60)	1 (1)	2 (1.30)	3 (1.57)	5 (3.93)	6 (8.53)	4 (2.33)
D. Resistance to resonant vibration Axial load	$\gamma/CE\sigma^{n-1}$	2 (22.0)	— —	— —	1 (1)	4 (75.0)	5 (120.9)	3 (73.2)

[a] Numbers in parentheses give relative weight of structure for material concerned in terms of weight of lightest structure.

ticity, L is the length of the column, and r is the radius of gyration of the cross-sectional area.

Another functional requirement is that the member resist a stress of given magnitude with no more than a certain strain within a specified time, e.g., the blades of a high-speed turbine may be so designed as to allow an elongation which increases with time (creep); but obviously within the specified life of the turbine the elongation must be limited so that the blades will not rub against the case of the turbine. For creep of plastics suitable relationships describing strain as a function of stress, time, and temperature are available (3,4).

Another functional requirement is that a structure resist fracture. Usually this requirement is interpreted to mean that the structure will not break in a relatively short time if a specified load is placed upon it. In the case of the tensile bar, for example, it may be required that the bar sustain a certain load indefinitely without fracturing.

The resistance of a member to a fatigue fracture (5), in contrast, refers to the number of times that the member can be loaded to a specified degree without rupture. Sometimes the functional requirement specifies the number of loadings as well as the type of loading.

Many structures are required to carry vibrating machines. Such structures might reasonably be expected to keep the amplitude of the induced vibrations below a specified level. An example of such a structure is a beam serving as a vibration isolator and carrying a heavy blower. In another case the structure may be required to damp out free vibrations at a rapid rate regardless of the size of the initial (reasonable) amplitude. In such problems the amplitude and frequency of applied loads must be correlated with the amplitude of the resulting vibration.

Still other structures may be required to absorb energy loads, such as impact loads. These structures may be designed to absorb energy with the idea of passing it on or back at a future time (e.g., automobile springs) or to absorb excess energy by self-destruction or permanent deformation (e.g., automobile bumpers and fronts). The impact loads on the structure may be related to the area under the stress versus strain curve of the material from which the member is to be fashioned: the area under the curve up to the yield point in the former case, or the area under the entire curve in the latter.

Throughout this discussion a dis-

tinction is made between the various values of quantities that are used in mathematical equations, such as the stress in the stress-strain relations, and the values of those properties that a given material can supply, such as the yield stress of a given material. The latter are denoted in this paper by the subscript "m", or by numerical subscripts for particular values.

Material Requirements

The fundamental purpose of a material, of course, is to provide a medium from which to manufacture the structure in question. The functional requirements specify loads that must be borne or certain properties or relations between properties that must be supplied by the material itself if the structure is to fulfill these requirements. For example, the functional requirement of the tensile bar described above is that the stress applied to the bar material and the modulus of elasticity be related in such a way that their ratio be not greater than δ/L. Since δ, L, σ, and E are related by Eq. 1, $\delta/L = \sigma/E$, and since L and the maximum value of δ are specified, the ratio of the design deflection δ to L has an upper limit specified. It follows, then, that for the material used $\sigma/E_m \leq \delta/L$. In addition, there is the implied requirement that the stress be not less in magnitude than P/A where A is the cross-sectional area of the bar. In order to qualify as a material of construction for this bar, then, a material would have to be capable of sustaining a stress of not less than P/A, and at the same time the ratio of the working stress to modulus of elasticity would have to be not greater than δ/L.

Looked at from this point of view, the choice of material becomes dependent on the functional requirements. If this train of thought is pursued further, it is noted that the stress, σ, is dependent on the cross-sectional area of the bar; hence, the choice of material becomes dependent also on the geometry of the bar (in particular, on the cross-sectional area). However, at least in this case, a particular material is not uniquely specified but rather a class of materials: namely, that class of materials that can withstand a stress of P/A (i.e., having chosen A, then $\sigma_m \leq P/A$) and for which the ratio of σ/E_m is less than or at most equal to δ/L.

When in addition to the above requirements the requirement that the bar weigh as little as possible is considered, then the class of suitable materials is further restricted to those for which

$$w = AL\gamma_m \qquad \text{Eq. 3}$$

assumes a minimum value, where w is the weight of the bar and γ_m is the specific weight (weight per unit volume) of the material. Since the length of the bar is fixed by the functional requirements, then for a given material the weight of the bar will be a minimum when the cross-sectional area is a minimum. Since $\sigma = P/A$, the weight of the bar will be a minimum when the stress is a maximum. In view of the functional requirements the following relations apply:

$$\sigma_m \geq P/A \qquad \text{Eq. 4}$$

$$\sigma/E_m \leq \delta/L \qquad \text{Eq. 5}$$

Since $\sigma = P/A$, Eq. 5 may also be expressed as

$$P/A\,E_m \leq \delta/L. \qquad \text{Eq. 6}$$

Hence A (cross-sectional area of bar) must satisfy the two inequalities of Eq. 4 and 6:

$$A \geq P/\sigma_m \qquad \text{Eq. 7}$$

$$A \geq PL/\delta E_m \qquad \text{Eq. 8}$$

Therefore, substituting Eq. 7 and

(To page 144)

Table II—Mechanical Properties of Selected Materials[1]

Material	Specific weight, γ, lb./in.^{3}	Tensile yield strength, σ, lb./in.^{2}	Shearing ultimate strength, τ, lb./in.^{2}	Tensile modulus of elasticity, E, lb./in.^{2}	Shearing modulus of elasticity, G, lb./in.^{2}	Stress coefficient of damping capacity, C, (lb./in.^{2})$^{1-n}$ per cycle	Stress exponent of damping capacity, n, dimensions
SAE X4130 steel	0.283(a)	80,000(a)	52,000(a)[3]	30×10^6(b)	11.2×10^6(a)	0.00043×10^{-10}(b)	3(a)
Titanium alloy	0.163(b)	130,000(b)	—	16×10^6(b)	6.0×10^6(i)	—	—
75 S-T aluminum alloy	0.101(b)	72,000(b)	47,000(b)	10.3×10^6(b)	3.9×10^6(b)	—	—
Paper laminate, phenolic	0.051(c)	22,500(c)	5,800(c)	2.4×10^6(c)	0.36×10^6(c)	$6,070\times10^{-10}$(f)	2(f)
Cast phenolic	0.048(d)	7,500(d)	9,400(e)	0.71×10^6(f)	0.28×10^6(f)	770×10^{-10}(f)	2(f)
Tough styrene	0.039(d)	3,400(d)	—	0.39×10^6(f)	0.116×10^6(f)	$1,560\times10^{-10}$(f)	2(f)
Crystal styrene	0.038(d)	6,500(d)	8,200(g)	0.40×10^6(f)	0.21×10^6(h)	$1,280\times10^{-10}$(h)	2(h)

[1] The values given are not necessarily the optimum for the type-material selected.

[2] Letters in parentheses refer to the source of the information, given below:

[3] Yield strength in shear

a. Robertson, J. M., and Yorgiadis, A., "Internal Friction in Engineering Materials," J. Appl. Mech., Trans. ASME 68, A173 (1946).

b. Hoyt, S. M., *Metal Data*, Reinhold Pub. Corp. (1952).

c. Findley, W. N., and Worley, W. J., "Mechanical Properties of Five Laminated Plastics," NACA Tech. Note No. 1560, (Aug. 1948).

d. *Technical Data on Plastics*, Manufacturing Chemists' Assoc., Inc. (Oct. 1952).

e. Schwartz, R. T., and Dugger, Edward Jr., "Shear Strength of Plastic Materials," MODERN PLASTICS, 21, 113 (Mar. 1944).

f. Unpublished data, Monsanto Chemical Co., Springfield, Mass.

g. Chaeatham, R. G., and Dietz, A. G. H., "Effect of Orientation on the Mechanical Properties of Polystyrene," MODERN PLASTICS, 29, 113 (Sept. 1951).

h. Podnieks, E., Johanson, C., and Lazan, B. J., "Round Robin Test Program on Dynamic Properties of Polyvinyl Chloride and Polystyrene Plastic," A Univ. of Minn. report to Section O of Subcommittee 1, ASTM Committee D-20 on Plastics (July 30, 1954).

i. Estimated, assuming Poisson's ratio equal 1/3.

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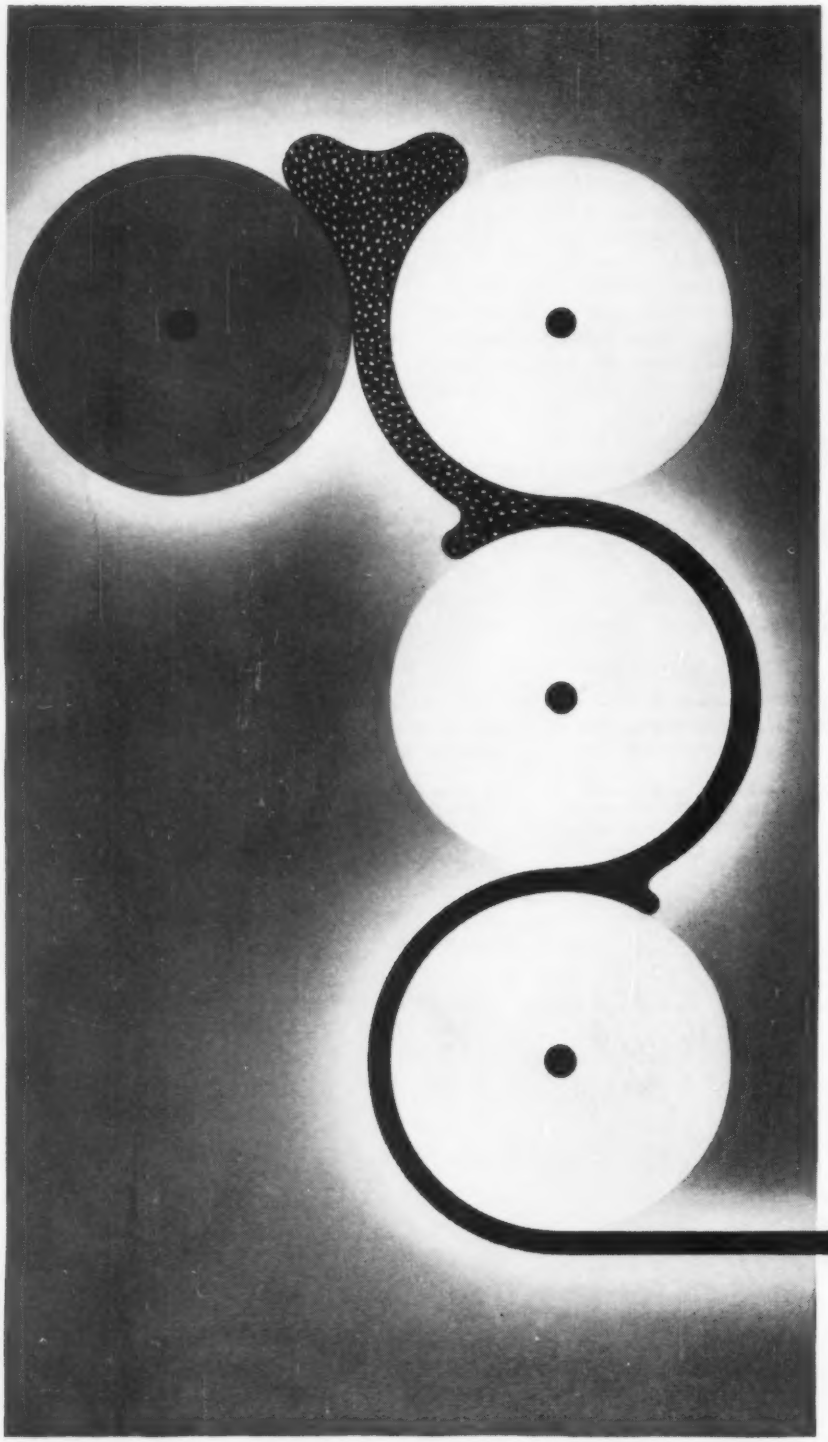

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8 in 3 it is found that w must satisfy the two inequalities:

$$w \geq (PL)(\gamma_m/\sigma_m) \qquad \text{Eq. 9}$$

$$w \geq (PL^2/\delta)(\gamma_m/E_m) \qquad \text{Eq. 10}$$

If R_m is defined to be the maximum value of

$$\sigma_m \text{ or } \frac{\delta}{L} E_m$$

in Eq. 10, then Eq. 9 and 10 become

$$w \geq (PL)(\gamma_m/R_m). \qquad \text{Eq. 11}$$

Thus, those bars will have minimum weight for which the equality of Eq. 11 holds. The functional requirements prescribe P, L, and δ. Since γ_m, E_m, and σ_m are properties of the material, their ratios can be considered variables dependent on the choice of material. In particular, that material will give as light a bar as possible for which the magnitude of the ratio γ_m/R_m is a minimum. Further limitation of the number of possible materials is not possible except by arbitrary designer's choices or by additional functional restrictions.

In the case considered, a particular set of functional requirements led to a criterion by which a material could be judged acceptable or not. The only apparent designer choice involved (the size of the bar area) was removed by the requirement that the bar weight be as small as possible.

There arises the question of the degree of freedom that the designer may exercise, i.e., the number of independent choices he may make in the deduction of a criterion for the choice of a material. The problem is answered in a quite straightforward way by the simple elimination of unknowns from the relations implicit in the symbolic statement of the functional requirements. Fundamentally these statements relate a) prescribed structural loads and b) geometry parameters to c) loads (stresses) on the material and to d) material properties (physical constants). By elimination of all possible quantities between the various conditions implied by the requirements, a functional relation is obtained between the material properties on the one hand and the (prescribed) loads, the geometry parameters (some of which may be prescribed), and any quantities introduced by the functional requirements on the other hand. The designer is free then either to choose the geometry parameters directly, or to introduce enough arbitrary functional relations between the shape parameters and the physical properties to make them dependent on the choice of the material, or to do a combination of both.

In the above problem the functional requirements were:

$$L\sigma/E_m \leq \delta \qquad \text{Eq. 12}$$

$$P/A \leq P/A \qquad \text{Eq. 13}$$

$$w = \gamma_m LA \qquad \text{Eq. 14}$$

Also in this problem the quantity A was eliminated; and the relation between w and the material properties γ_m, σ_m, and E_m was found to contain the geometry parameter L, the load parameter P, and the structural parameter δ. All of the last three were prescribed. Hence, the condition that w be as small as possible completely determined the criterion, and, therefore, the designer had no modifying material choice at all unless more than one material considered attained the minimum weight for the bar.

Consider, however, the case in which a simply supported beam of uniform cross-section and length L is required to carry elastically a load P at its midpoint. The service requirement implies

$$\sigma_m \geq \frac{PL}{4}\frac{c}{I} = \frac{PL}{4}\frac{c}{Ar^2} \qquad \text{Eq. 15}$$

where c is the distance from the neutral axis of the beam cross-section to the most distant fiber, and I and r are respectively the moment of inertia and the radius of gyration of the cross-sectional area about the neutral axis. In addition, it is required that

$$w = \gamma_m AL \qquad \text{Eq. 16}$$

be a minimum. Eliminating A between these two requirements the following results

$$w \geq \frac{\gamma_m}{\sigma_m}\frac{PL^2}{4}\frac{c}{r^2} \qquad \text{Eq. 17}$$

In Eq. 16 and 17 P and L are prescribed while γ_m and σ_m are properties of the material. Hence the designer is free to choose two parameters: c and r.

The actual weight of the beam can be made least for a given ratio of c/r^2 when the ratio of γ_m/σ_m is least. However, the designer may sacrifice one of his degrees of freedom in choosing his geometry parameters by adopting an additional restriction either between them or between them and some other physical property. In this case it is not necessarily true and is very often not true that the optimum material is that which possesses the lowest ratio of γ_m/σ_m. For instance, suppose the additional requirements were that the cross-section should be rectangular with width b and depth h. Furthermore, suppose b were prescribed. Then Eq. 16 becomes

$$w = Lbh\,\gamma_m \qquad \text{Eq. 18}$$

and Eq. 15 becomes

$$\sigma_m \geq \frac{PL}{4}\frac{h/2}{bh^3/12} \qquad \text{Eq. 19}$$

Eliminating h between Eq. 18 and 19 the expression for minimum weight becomes:

$$w \geq \left(\frac{3PL^2b}{2}\right)^{1/2}\frac{\gamma_m}{\sigma_m^{1/2}} \qquad \text{Eq. 20}$$

Since the first radical is determined by the prescribed requirements, the optimum material is that for which the ratio $\gamma_m/\sigma_m^{1/2}$ is a minimum. Other special requirements could lead to different criteria.

It is essential to note that the criteria for the choice of structural materials are dependent on the uses for which the structures are designed, and that no one criterion is applicable in all cases. Specifically, the use of that material for which the over-popular strength-weight ratio, σ/γ, is a maximum, does not by any means assure that the lightest structure has been attained.

This point may be illustrated by the last example in which the lightest beam that could be made from a given material would be that for which the equality of Eq. 20 holds. Hence the ratio of the weight of the beams that could be made from two different materials designated by subscripts 1 and 2 can be computed directly from Eq. 20:

$$\frac{w_1}{w_2} = \frac{\gamma_1/\sigma_1^{1/2}}{\gamma_2/\sigma_2^{1/2}} \qquad \text{Eq. 21}$$

Note that since all other quantities are prescribed and, therefore, identical, they are automatically suppressed by the division. If more than two materials are to be compared, they may be listed in order of increasing weight of the beam that can be made from them. The order of listing will be the same as the order of listing of the values of the corresponding ratios of γ_m to $\sigma_m^{1/2}$. In general, the order of listing obtained from the criterion $\gamma_m/\sigma_m^{1/2}$ will not

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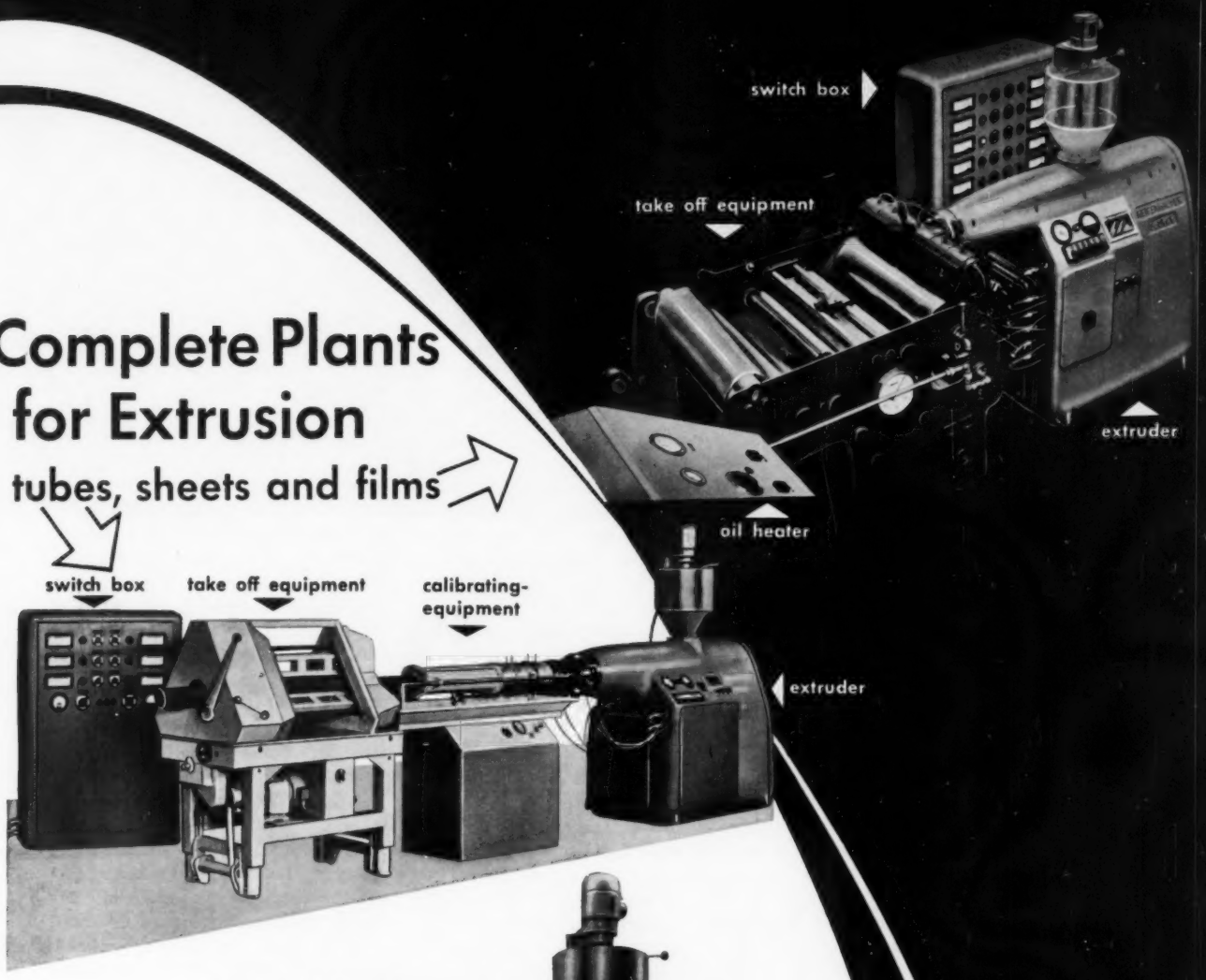

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be the same as would have been obtained from the criterion γ_m/σ_m.

Indeed, even among relatively simple elements of engineering structures there are many different criteria for minimum weight, depending on the service conditions required of the structural element. A few examples have been worked out in the Appendix, p. 148ff.

Discussion

With regard to the derivation of the criterion it should be pointed out that the method used here was to obtain an expression for the weight of the structural element in question and to minimize it. An alternate procedure employed in reference (1) would have been to find what degree of service of a specified nature (such as load carrying capacity) could be obtained from equal weights of different materials. That material which furnished optimum service for a given weight would also be the material that performed the given service with minimum weight. It can be shown that the criterion obtained in the second procedure is some power of the reciprocal of that obtained in the first.

The geometric forms considered in the Appendix have been chosen without regard to special fabricating procedures used with particular materials. In many cases failure to consider this factor works a hardship on some materials. For instance, if it were required to make a floor of low weight—say an aircraft cabin floor—a foam-center type of slab would certainly be considered for construction of plastics but not for aluminum. Hence, to include foam-center construction is to be biased against aluminum; not to include it would be to neglect the extremely low average density of plastic foam-center construction.

With regard to the functional requirement of minimum weight of the structure, it is immediately apparent that the methods presented here can be employed for other requirements. An entirly analogous method could be presented for, say, minimum cost. The basic premise is that the service required of a material determines—at least partially—the criterion by which materials are judged suitable for that use.

The explicit dependence of the criterion on a few of the properties of the material suggests that design codes may have been unnecessarily severe and that, as a consequence, the number of materials considered for particular uses may be too few. When considering new materials the method permits a tentative evaluation of the new material relative to those currently employed. For example, in Table I, p. 140, plastics are outstanding in three and compare favorably with metals in seven of the nine types of service.

Since the number of restrictions has not and indeed cannot be limited, the possibility arises that two or more different criteria for the selection of a material for a given structural member may apply simultaneously. In such cases the criteria will help limit the material possibilities; but the simultaneous satisfaction of all criteria by one material can only be fortuitous.

Perhaps the easiest way to see this fact is to note that unless there is a functional relation between the criteria, it is impossible to characterize the performance of the material with respect to each criterion by one parameter. For if it were possible, then to every value of one criterion there would correspond a value of the parameter; and for every value of the parameter there would correspond a value of each of the other criteria. In particular, the values of any one of the criteria would determine the corresponding values of any other. But this situation violates the assumption that there exists no functional relation between them. Even if there were a functional relation, the chance that both criteria would indicate the same material is slim; if there were not a functional relation, the chance is almost negligible. In neither case could a single parameter be expected to indicate performance levels of different materials with respect to different criteria. Therefore, it will be necessary for the designer either to choose outright one of the possible materials, or to establish (equally arbitrarily) some additional weighting of the various criteria.

To illustrate the above discussion a few simple examples have been prepared in Table I, p. 140, listing in the order of increasing weight, the seven materials chosen for the structural requirement indicated in the first column. The applicable criterion for the selection of materials in each case (see Appendix for derivation) is indicated in the second column. The data on material properties used in the determination of these ratings are given in Table II, p. 141.

With regard to Table I, it is admitted that the analysis is not complete, e.g., the effect of temperature has not been mentioned; nor has the effect of damping in increasing the temperature been considered; nor has the effect of fatigue or creep been estimated. On yet a more elementary level the material requirements of shear stresses in beams have not been included. These and others could have been included, but were not for the sake of simplicity. The point to be demonstrated, however, would not have been changed: the choice of the optimum material is dependent upon the structural use, and no one material is optimum for all structural uses.

Another point to be mentioned is that data do not exist in easily accessible form for the ready comparison of large numbers of different materials for many different design criteria. Table I is obviously quite restricted. Even so, to compile the table the authors have had to use direct contact with manufacturers, reference books on metals, and papers on particular subjects not primarily designed to furnish these data. To make such a table entirely complete without actual experimentation is often impossible and in any case not in the province of the designer. Yet without complete lists of physical properties, the designer cannot make intelligent selection of optimum materials of construction.

Conclusions

1. The choice of construction materials is dependent upon the usage required of these materials. There is no single criterion or figure of merit (such as the strength-weight ratio) applicable in all types of service to guarantee minimum weight.

2. The recognition of different criteria for different structural uses suggests that the choice of materials for lightweight structures has been unduly limited.

3. At least one new class of construction materials to be considered for reasons of light weight is plastics, particularly for lightweight structures that resist resonant vibrational frequencies.

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materials are inadequately arranged for ready comparison with the corresponding data for other materials of construction.

Appendix

Derivation of Criteria for:

A. Adequate strength

1. Axial loading of a tension (or short compression) member:

The functional specifications are: load P, length L, and minimum weight. The implied material property required is

$$\sigma_m \geq P/A \qquad \text{Eq. 22}$$

where σ_m is the maximum allowable tensile (or compressive) stress in the material. Minimum weight requires:

$$w = \gamma_m AL \qquad \text{Eq. 23}$$

Eliminating A between Eq. 22 and 23 and taking the minimum:

$$w_{min.} = PL\frac{\gamma_m}{\sigma_m} \qquad \text{Eq. 24}$$

The relative weight of members made of materials 1 and 2 for the same functional specifications given above is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/\sigma_1}{\gamma_2/\sigma_2} \qquad \text{Eq. 25}$$

2. Bending of a simply supported beam:

Case a—The functional specifications are: length L, rectangular cross-section with width b (depth h to be determined); beam to carry load P at midpoint; and minimum weight. The implied material property required is:

$$\sigma_m \geq Mc/I \qquad \text{Eq. 26}$$

where M is the applied bending moment, c is the distance from the neutral axis to the most distant fiber, and I is the moment of inertia of the cross-sectional area about the neutral axis. The minimum weight requires that

$$w = \gamma_m bhL \qquad \text{Eq. 27}$$

For the rectangular cross-section Eq. 26 becomes

$$\sigma_m \geq \frac{PL}{4}\,\frac{h/2}{bh^3/12} \qquad \text{Eq. 28}$$

Eliminating h between Eq. 27 and 28 and taking the minimum, we then have the expression

$$w_{min.} = (3PbL^2/2)^{1/2}\,(\gamma_m/\sigma_m^{1/2}) \qquad \text{Eq. 29}$$

The relative weight of beams made of materials 1 and 2 for the same functional specifications given above is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/\sigma_1^{1/2}}{\gamma_2/\sigma_2^{1/2}} \qquad \text{Eq. 30}$$

Case b—The same functional specifications and material property as Case a, except that the depth h instead of the width b is specified. Eliminating b between Eq. 27 and 28 and taking the minimum:

$$w_{min.} = (3PL^2/2h)\,(\gamma_m/\sigma_m) \qquad \text{Eq. 31}$$

The relative weight of beams made of materials 1 and 2 for the same functional specifications given just above is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/\sigma_1}{\gamma_2/\sigma_2} \qquad \text{Eq. 32}$$

Compare Eq. 30 and 32 and note that the criteria are different.

3. Torsion of a cylindrical shaft:

The functional specifications are: length L; solid circular cross-section of diameter D; applied torque T; and minimum weight. The implied material property required is:

$$\tau_m \geq Tc/J \qquad \text{Eq. 33}$$

where τ is the maximum allowable shear stress, T is the applied torque, J is the polar moment of inertia of the cross-section, and c is the distance from the pole to the most distant fiber. Minimum weight requires

$$w = \gamma_m \pi D^2 L/4 \qquad \text{Eq. 34}$$

For the circular cross-section Eq. 33 becomes

$$\tau_m \geq 16T/\pi D^3 \qquad \text{Eq. 35}$$

Eliminating D between Eq. 34 and 35 and taking the minimum:

$$w_{min.} = (4\pi)^{1/3} LT^{2/3}\,(\gamma_m/\tau_m^{2/3}) \qquad \text{Eq. 36}$$

The relative weight of shafts made of materials 1 and 2 for the same functional specifications given above is

$$\frac{w_1}{w_2} = \frac{\gamma_1/\tau_1^{2/3}}{\gamma_2/\tau_2^{2/3}} \qquad \text{Eq. 37}$$

B. Adequate stiffness*

1. Axial loading of a tension (or short compression) member:

The functional specifications are the stiffness ratio of load P to deflection δ; length L; and minimum weight. The implied material property required is:

$$AE_m/L \geq P/\delta \qquad \text{Eq. 38}$$

Minimum weight requires

$$w = \gamma_m LA \qquad \text{Eq. 39}$$

Eliminating A between Eq. 38 and 39 and taking the minimum, we have the expression

$$w_{min.} = (PL^2/\delta)\,(\gamma_m/E_m) \qquad \text{Eq. 40}$$

The relative weight of members made of materials 1 and 2 for the same functional specifications given above is

$$\frac{w_1}{w_2} = \frac{\gamma_1/E_1}{\gamma_2/E_2} \qquad \text{Eq. 41}$$

2. Bending of a simply supported beam:

Case a—The functional specifications are: load P at midpoint; rectangular cross-section with width b; length L; stiffness ratio P/δ, where δ is the deflection of the beam at its midpoint; and minimum weight. The implied material property required is:

$$48\,E_m\,I/L^3 = 4\,E_m bh^3/L^3 \geq P/\delta \qquad \text{Eq. 42}$$

for a rectangular cross-section. Minimum weight requires

$$w = \gamma_m Lbh \qquad \text{Eq. 43}$$

Eliminating h between Eq. 42 and 43 and taking the minimum, we have the expression

$$w_{min.} = L^2(Pb^2/4\,\delta)^{1/3}\,(\gamma/E^{1/3}) \qquad \text{Eq. 44}$$

The relative weight of beams made of materials 1 and 2 for the same functional specifications given above is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/E_1^{1/3}}{\gamma_2/E_2^{1/3}} \qquad \text{Eq. 45}$$

Case b—The same functional specifications and material property as Case a, except that depth h instead of width b is specified. Eliminating b between Eq. 42 and 43 and taking the minimum, we have the expression

$$w_{min.} = (PL^4/4\delta\,h^2)\,(\gamma/E) \qquad \text{Eq. 46}$$

The relative weight of beams made of materials 1 and 2 for the same functional specifications given just above is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/E_1}{\gamma_2/E_2} \qquad \text{Eq. 47}$$

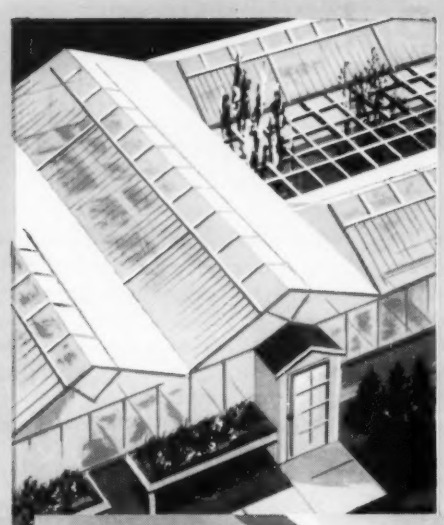
Note that the criteria of Eq. 45 and 47 are different.

3. Torsion of a cylindrical shaft:

The functional specifications are: length L, solid circular cross-section; stiffness ratio T θ where θ is the angle through which the shaft twists; and minimum weight. The implied

(*To page* 216)

*In this section it is assumed that σ_m is greater than the applied stress in all cases. If this condition were subject to doubt, a treatment analogous to that on page 141 would be necessary.



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Making Monomers and Polymers – WITH SODIUM

by MARSHALL SITTIG*

THE field of plastics technology is constantly embracing new materials and new uses for old materials. One old material that is finding a number of important new uses is metallic sodium. Surprisingly, these new uses offer great variety to the plastics industry, in that they apply to the manufacture of monomers, polymers, plasticizers, stabilizers, and even to various heating uses.

Sodium is now a heavy chemical with production of over 250 million lb. per year and with a corresponding low price in ton lots of only 16¢ per pound. Also, and most important, handling techniques have been developed so that sodium can be handled safely and easily, with only the same degree of precaution you use every day in handling flammable solvents, vigorous polymerization catalysts, or many monomers.

Monomers

Sodium can serve as an agent for the production of a number of monomeric materials. One of these is isosebacic acid which is produced by the reaction of butadiene with sodium, followed by carbonation of the addition product with carbon dioxide, as shown by the following equations:

$$2\,CH_2{=}CHCH{=}CH_2 + 2\,Na \rightarrow C_8H_{12}Na_2$$

$$C_8H_{12}Na_2 + 2\,CO_2 \rightarrow C_8H_{12}(CO_2Na)_2$$

This process has been described by Walker (1) and a commercial plant for isosebacic acid manufacture, presumably by this process, is being erected and is scheduled to begin operation in 1955. The product has been suggested as a raw material for the manufacture of alkyd resins or for plasticizers.

Another route to dibasic acids having possible application in alkyd resin manufacture is through the combination of sodium with acetylene, followed by carbonation of the product, according to the equation:

$$HC{\equiv}CH + 2\,Na \rightarrow NaC{\equiv}CNa + H_2$$

$$NaC{\equiv}CNa + 2CO_2 \rightarrow NaO_2CC{\equiv}CCO_2Na$$

Organosilicon compounds as raw materials for silicone resins can be prepared by the interaction of organic halides with alkyl orthosilicates in the presence of sodium, as described by Taylor (2).

The manufacture of ε-caprolactam as a monomeric raw material for a nylon-type polymer can be accomplished through the use of sodium azide. Sodium azide is made from metallic sodium by the following sequence of reactions:

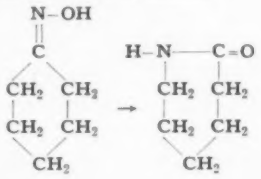
1) Sodium plus ammonia yields sodium amide:

$$Na + NH_3 \rightarrow NaNH_2 + \tfrac{1}{2}\,H_2$$

2) Sodium amide plus nitrous oxide in liquid ammonia gives sodium azide:

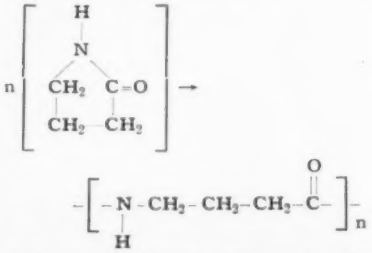
$$2\,NaNH_2 + N_2O \rightarrow NaN_3 + N_2OH + NH_3$$

Sodium azide then reacts with cyclohexanone in the presence of water as a solvent and hydrochloric acid as the catalyst to give ε-caprolactam, as described by Smith (3). This is the Schmidt reaction wherein cyclohexanone oxime is formed as an intermediate and undergoes rearrangement to the caprolactam according to the equation:



Polymers

Sodium has long been known as a polymerization catalyst for a variety of unsaturated compounds, particularly of conjugated diene hydrocarbons. One recently patented application of sodium as a polymerization catalyst covers the manufacture of a thermoplastic material suitable for synthetic fiber manufacture from pyrollidone. The equation



is presented by Ney, Nummy, and Barnes (4).

As mentioned above, however,

Special oil-jacketed storage tanks at a metallic sodium "tank farm"

Courtesy Ethyl Corp.

* Ethyl Corp.

[1] Numbers in parentheses link to references at end of article, p. 218.

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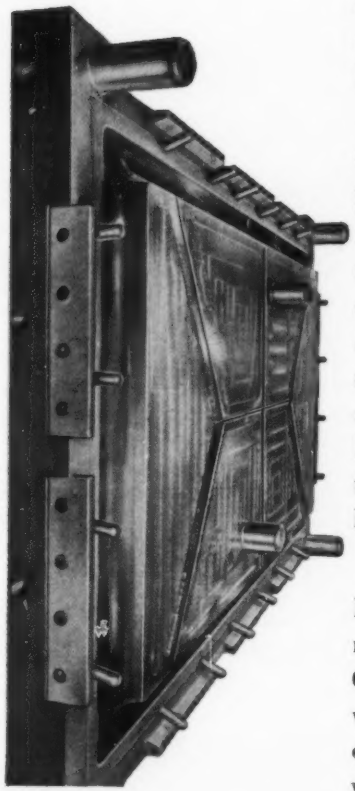

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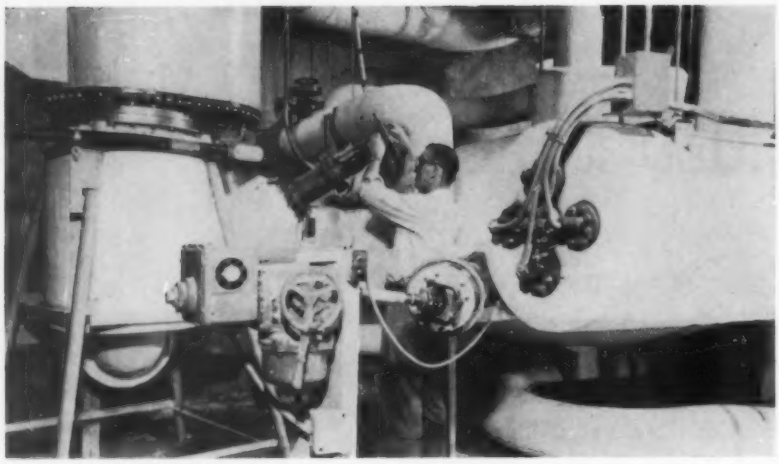


Courtesy Idaho Operations Office

Large liquid sodium pump at the National Reactor Testing Station in Idaho typifies the special equipment for handling sodium on large scale that has been developed in connection with the atomic energy program and which, in large part, is now available to industry

most of the success of sodium as a polymerization catalyst has been in diene polymerization. This work has fallen into three general classes:

1) Polymerization of butadiene by sodium metal, in massive or dispersed form—the Buna process.

2) Polymerization of butadiene by sodium metal together with certain activators—the Alfin catalyst process.

3) Polymerization of butadiene-styrene mixtures by sodium metal dispersed in inert hydrocarbons—a modified GR-S process.

Buna Process—The name "Buna" for the sodium-catalyzed rubber was, of course, coined from "bu" for butadiene and "na" from the German word for sodium, natrium. The technique was first disclosed at almost the same time in England by Matthews and Strange and in Germany by Harries. All this is well known. What is not so nearly well known is that sodium-polybutadiene rubbers were produced in Germany as late as during World War II. These Buna rubbers were numbered, according to arbitrary viscosity measurements. Thus, Buna 32 and Buna 115 were made by a sodium-catalyzed batch process at 80° C. and at 20° C., respectively.

Buna 85 was made by an interesting continuous process, catalyzed by potassium rather than sodium. This continuous polymerization technique has been described in a patent by Ebert, Heidebrock, and Orth (5).

In addition to the numbered Bunas described above, a low-molecular weight polymer called Butol was made by the vapor-phase polymerization of recovered butadiene over sodium. This product was a liquid, intended for use as a plasticizer, and its manufacture consisted of passage of butadiene vapors at room temperature into a reactor containing finely-divided sodium dispersed in polyisobutylene paste.

Alfin Catalyst Process—Work by Professor A. A. Morton and his students at the Massachusetts Institute of Technology has resulted in a unique type of sodium polymerization catalyst called the Alfin catalyst. These materials were discovered accidentally as a result of diisopropyl ether addition in an experiment on the addition of organosodium compounds to dienes. It is believed that the ether is split into a mixture of an alcoholate and an olefin, and the name Alfin is coined from *al*coholate and ole*fin*. An excellent review of the results of these Alfin catalyst studies has been published by Morton (6).

Modified GR-S Process—Both sodium metal and sodium hydride (made by the direct combination of sodium with hydrogen) have been used as catalysts for polymerization of butadiene-styrene mixtures, according to Dunbrook (7). Work on the use of dispersions of sodium metal in inert hydrocarbons for the polymerization of butadiene plus styrene was carried out in this country during World War II. Marvel, Bailey, and Inskeep have reported on the results of some of these studies (8). Other work has been published by Crouch (9), Schulze and Crouch (10), and Schulze, Crouch, and Lynch (11).

Elastomers are not the only possible products of the sodium-catalyzed reaction of butadiene and styrene, however. Synthetic drying oils of improved properties may be produced by a variation of the reaction, according to Gleason (12) and Gleason and Leary (13).

Plasticizers

Two possible routes to plasticizers made with the aid of sodium have already been discussed in this article—through isosebacic acid and through production of a low-molecular weight polybutadiene.

Still another valuable potential source of plasticizers through sodium chemistry is from the reduction of natural fats and oils to long-chain fatty alcohols. These alcohols can be employed as plasticizers, unchanged, or in the form of their organic or inorganic esters.

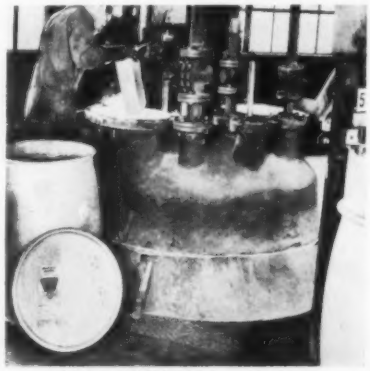
The general equation for the sodium reduction process is as follows:

$$RCOOR' + 4\,Na + 2\,R''OH \rightarrow RCH_2ONa + 2\,R''ONa + R'ONa$$

Alcohols exhibiting a wide range of composition as regards chain length and degree of unsaturation can be produced by the sodium reduction process. Unlike hydrogen reduction, sodium reduction (and only sodium reduction) permits the production of unsaturated alcohols from unsaturated esters. This unsaturation affords a second point of reactivity, very useful in a plasticizer.

The product alcohols from the so-

(*To page* 217)



Courtesy Ethyl Corp.

Operator adding sodium brick to reaction kettle during one phase of the manufacture of an organic intermediate

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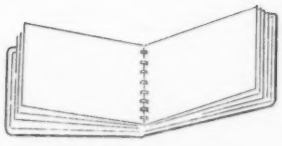

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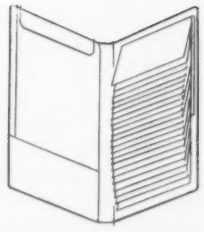

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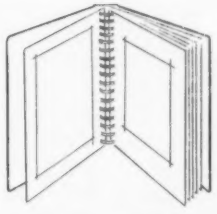

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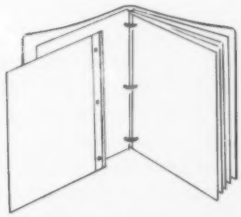

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

General

SOME PROMISES, FAILURES, AND FULFILMENTS OF PLASTICS. C. A. Redfarn. Plastics Inst. Trans. *23*, 78-104 (Apr. 1955). A critical historical review of the development and applications of various classes of plastics is presented. Advantages and disadvantages of each class are stressed. Twenty pages of discussion with additional information from a variety of readers are included.

SOME RADIATION EFFECTS IN LONG-CHAIN POLYMERS. A. Charlesby. Plastics Inst. Trans. *23*, 133-38 (Apr. 1955). The effects of atomic pile radiation on polymers are reviewed briefly.

Materials

FIBROUS TEFLON. B. S. Farquhar. Product Engineering *25*, 190-93 (Dec. 1954). A new synthetic fiber, tetrafluoroethylene polymer in continuous filament form, has been developed. The official name of the new synthetic is Teflon tetrafluoroethylene fiber. The new fiber combines the chemical inertness and high heat resistance of the usual Teflon plastics with additional important properties resulting from its new physical form. Industrial rather than apparel end uses are suggested and are predicated on the fact that the fiber will show a sufficiently long life so that, when performance is measured against cost, economies will result. In field performance tests, the Teflon fiber in the form of woven fabrics is proving superior to other available materials in such applications as packings for pump shafts, gasketing, gas or liquid filtration, roll covering, and conveyor uses. Shrinkage of the fabric in high-temperature applications can be prevented by preshrinking the material at temperatures above the contemplated service temperature. A temperature of 525° F. is considered the maximum long-term limit. Methods for processing Teflon fiber into fabrics are discussed. As yet there is no staple fiber available, but a fiber-stock material is available, and a 400-denier yarn with 60 filaments is being produced experimentally.

EMULSION-POLYMERIZED POLYSULFONE RESINS. W. W. Crouch and J. E. Wicklatz. Ind. Eng. Chem. *47*, 160-65 (Jan. 1955). An emulsion process is described for the copolymerization of unsaturated organic compounds with sulfur dioxide to yield polysulfone resin latices from which the thermoplastic resins are recovered by coagulation. The process is applicable to a variety of olefinic hydrocarbons including 1- and 2-butenes, higher aliphatic monoölefins, cycloölefins, and butadiene. Tertiary olefins do not react under usual conditions, and in admixture with polymerizable olefins they retard the reaction. Polysulfones of improved thermal stability are obtained by the use of small quantities of certain non-hydrocarbon monomers such as acrylonitrile and ethyl acrylate in the polymerization charge or by the addition of stabilizers to the resins. A number of plasticizers have been found to be compatible with the resins. The polysulfones are also compatible with butadiene-acrylonitrile rubbers to give compounds of greatly improved impact resistance.

SILICONES—USES AND INDUSTRIAL APPLICATIONS. H. R. H. Miller. Canadian Plastics *1954*, 51-54, 82 (Dec. 1954). The development, uses, and industrial applications of the silicone materials are reviewed from the standpoint of greatest interest in the plastics field. All commercial silicones share the properties of durability to weathering, resistance to heat and cold, and water repellency. Another common, but not universal property of silicones is incompatibility with organic materials. These characteristic properties have led to such applications as release agents, greases, cutting oils, coatings for paper or parchment to make it both water-repellent and non-adhesive, sizes for glass fibers, and adhesives. In this latter category, a new pressure-sensitive silicone adhesive has been developed which it is claimed will stick anything to anything—even polyethylene, Teflon, and other silicones. It will also stick to wet surfaces, even under water.

POLYMERIZABLE DERIVATIVES OF LONG-CHAIN FATTY ACIDS. VINYL STEARATE AND COPOLYMERIZATION OF VINYL CHLORIDE WITH OTHER VINYL ESTERS. W. S. Port, E. F. Jordan, W. E. Palm, L. P. Witnauer, J. E. Hansen, and D. Swern. Ind. Eng. Chem. *47*, 472-80 (Mar. 1955). As part of a general study of the utilization of fatty derivatives in plastics, copolymers of vinyl chloride with vinyl stearate and other vinyl esters were prepared and their mechanical, thermal, viscoelastic, and viscous properties were determined. The study was undertaken to determine whether true plasticization (impartation of flexibility without irrecoverable flow) could be achieved by copolymerization and whether the length of the acyl chain of the comonomer affects the efficiency of internal plasticization. Copolymers of vinyl chloride containing less than about 25% vinyl stearate have improved properties in some respects as rigid vinyls, because they have lower milling temperatures and a lower melt viscosity-temperature coefficient. Copolymers containing 30 to 50% of vinyl stearate are flexible and resemble compositions of polyvinyl chloride and external plasticizers in their mechanical and thermal characteristics. Both the rigid and flexible types may be useful for extrusion, because they are preplasticized. A long acyl chain is desirable because as the acyl chain length is progressively decreased from C_{18} to C_2, the internal plasticizer efficiency decreases progressively.

FILLED FLUOROCARBONS. NEW COMPONENT MATERIALS. M. A. Rudner. Elec. Mfg. *55*, 80-87, 326 (Feb. 1955). Comprehensive data are presented on the compounding, properties, and applications of filled polytetrafluoroethylene compositions. Nothing can be added to the fluorocarbon to improve its electrical or chemical properties; these, particularly the dissipation factor and the dielectric

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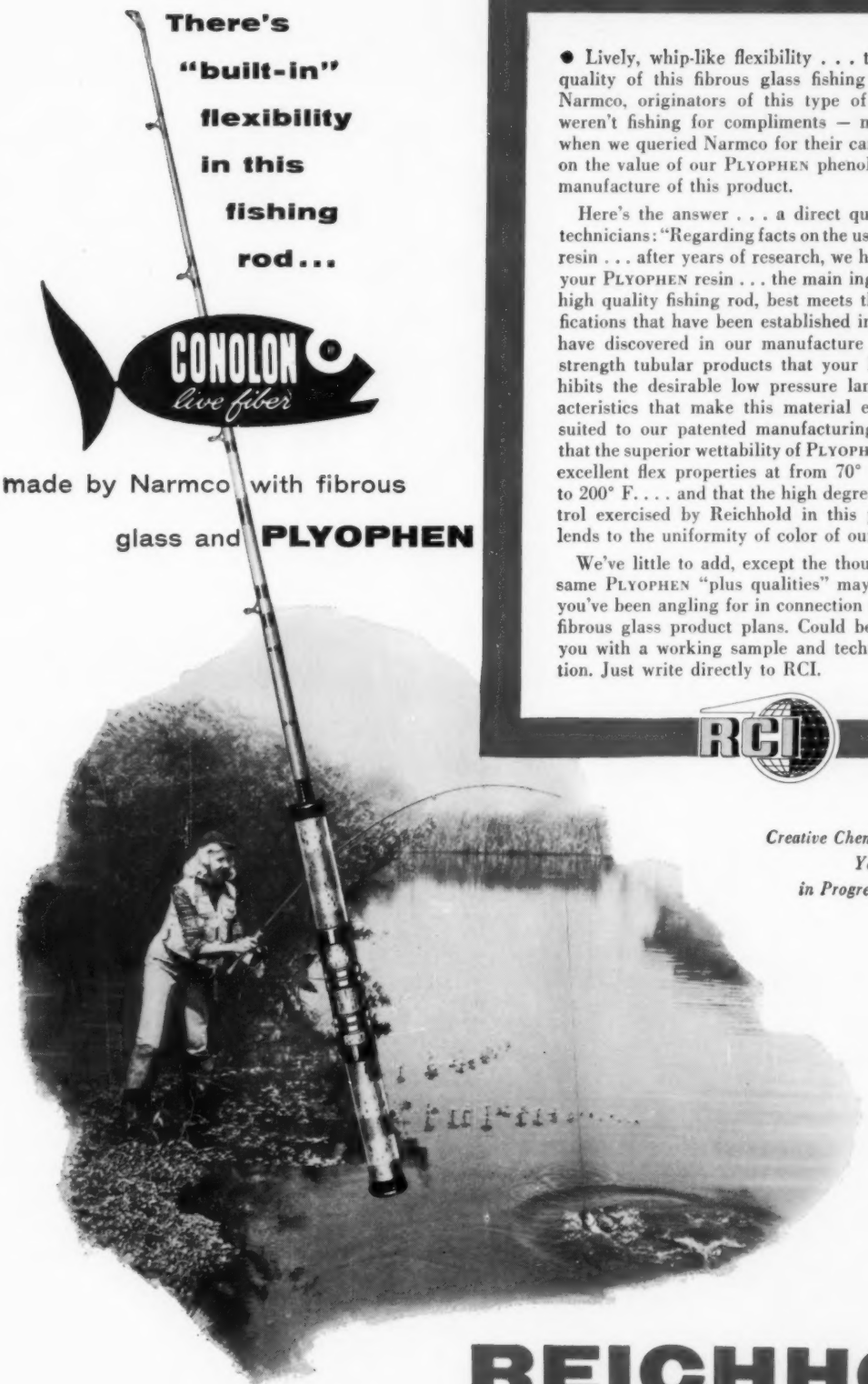

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constant, are degraded by any filler. The main applications for filled fluorocarbons are where some loss in electrical properties can be accepted for the sake of desired improvements in mechanical or thermal properties or cost. The particular objective of the present investigation was to develop special-property dielectric, magnetic, semiconductive, and resistive materials. Since high sintering temperatures (621 to 720° F.) are required for adequate fusion, only thermally stable fillers should be used. An intimate and homogeneous mixture of fine resin and filler particles must be obtained before the preform is made ready for sintering. The over-all properties of the mixture are determined by the type and percentage of filler, the methods of mixing, molding, and sintering, and the particle size of the fluorocarbon resin and of the filler. The filled fluorocarbon compositions can be made superior to unfilled Teflon in such properties as resistance to deformation under load, wear resistance, stiffness, thermal conductivity, compressive strength, and hardness without impairment of such properties of the original Teflon as low coefficient of friction, heat resistance, outdoor durability, nonflammability, zero water absorption, and high flexural strength; elongation and impact strength, however, decrease with increasing amounts of filler; the electrical properties, at low filler loadings, remain excellent.

REINFORCING EFFECT OF CONDENSATION POLYMERS ON RUBBER IN CONNECTION WITH THEIR PARTICLE SIZE. R. Houwink and J. Van Alphen. J. Polymer Sci. *16*, 121-30 (Apr. 1955). The reinforcing effects of cyclized rubber, aniline-formaldehyde, and polystyrene resins on rubber are reported. The best effects are obtained when chemical bonds between the resins and rubber are formed. Better effects are also obtained with harder resins.

CURED POLYVINYL FORMAL SHEET. M. M. Sprung, F. O. Guenther, and M. T. Gladstone. Ind. Eng. Chem. *47*, 305-14 (Feb. 1955). Sheet insulation based on polyvinyl formal can be formed by milling or calendering with the aid of fugitive plasticizing agents, followed by thermal cure. The sheet material can be modified by the use of cross-linking agents, of

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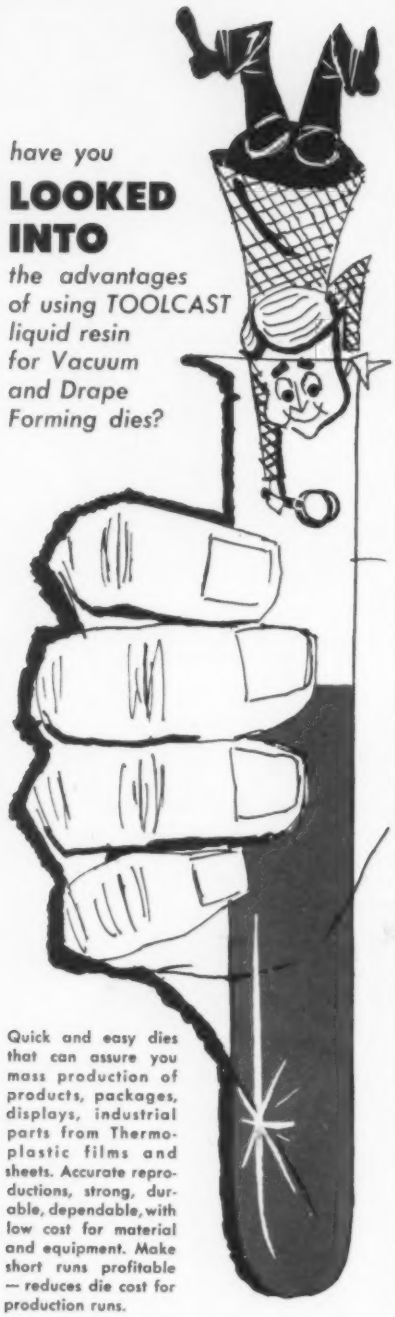

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which the most effective is a phenol-formaldehyde resin. Physical and chemical changes that occur when polyvinyl formal and polyvinyl formal-phenolic sheets are heated for long periods of time are described in detail. Changes in flexibility, area, and weight, and the rates of formation of specific decomposition products are emphasized. These changes occur at relatively high rates in the presence of excess air but much more slowly when only limited quantities of air are available and are reduced much further in nitrogen, in dichlorodifluoromethane, or in a vacuum. Thermally cured polyvinyl formal is much more stable under the conditions studied than polyvinyl formal powder or uncured sheet. Polyvinyl formal, modified with a cresol-formaldehyde resin and heat cured, is still more stable toward both physical and chemical change.

ISOCYANATES—THEIR FORMATION, REACTIONS, AND APPLICATIONS. R. D. Hirschbeck. Plastics Technology *1*, 95-99 (Mar. 1955). The chemistry and polymers of isocyanates are reviewed.

WEATHERING OF POLYVINYL CHLORIDE. J. B. DeCoste and V. T. Wallder. Ind. Eng. Chem. *47*, 314-22 (Feb. 1955). Natural and accelerated weathering tests show that polyvinyl chloride compositions can be formulated that are suitable for long-time outdoor service. The exclusion of sunlight from the body of the plastic represents the major formulation problem. Unprotected polyvinyl chloride systems degrade rapidly when exposed to the weather. This degradation may be retarded through the incorporation of suitable basic lead salts capable of acting as light screens. A relationship was demonstrated to exist between light absorption of lead stabilizers and the improvement in weathering that is obtained. The use of lead salts alone is not believed to be sufficient to sustain polyvinyl chloride compositions for long-time outdoor service in all climates. Further protection through light-shielding pigments is considered necessary. The best protection is provided by small particle size carbon black. This pigment gives protection to compositions prepared from a variety of plasticizers. Where color is important, a rutile titanium dioxide treated with aluminum, zinc, and silicon gives a white base with good weatherability to which colorants may be added. Titanium dioxide has been found to be most effective with octyl phthalate type plasticizers.

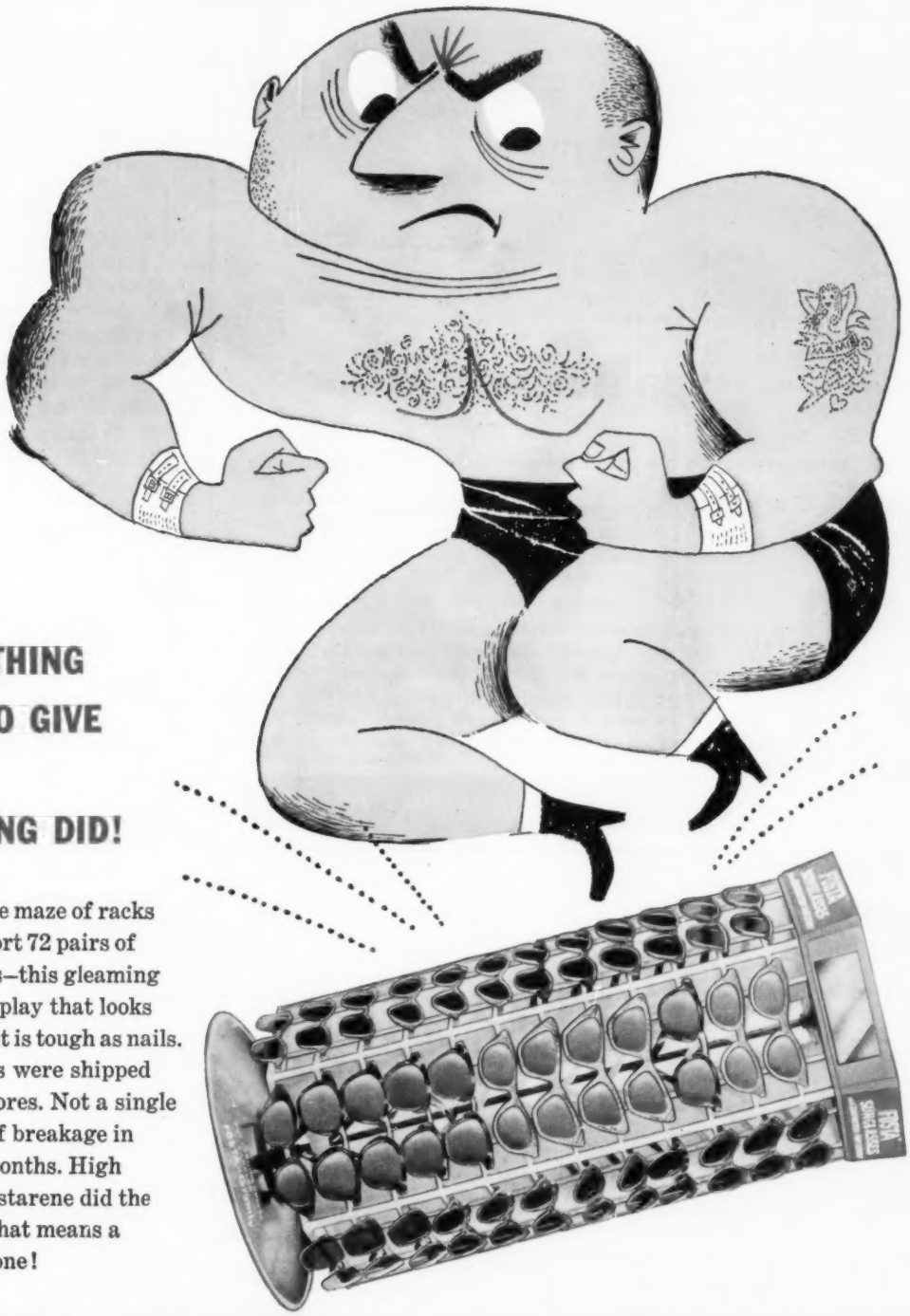
Molding and Fabricating

HORIZONTAL PELLETING MACHINES. W. R. Groves. Plastics Inst. Trans. *23*, 105-11 (Apr. 1955). The disadvantages of vertical pelleting machines are reviewed. The principle of operation, advantages, and technique of operation of horizontal pelleting machines are described in detail.

MOLDING PROCEDURES AND MOLD DESIGN FOR MELAMINE-FORMALDEHYDE MATERIALS. J. Butler. Plastics Inst. Trans. *23*, 113-19 (Apr. 1955). Techniques for molding melamine plastics are reviewed. One important factor, considered in detail, is proper mold design.

Applications

PLASTICS TOOLING. M. M. Riley, Materials and Methods *41*, 89-93 (Jan. 1955). The only methods being widely used to make plastics tools are casting under gravity feed, laminating under contact pressures, or a combination of both. The major advantage in casting a tool is the relative speed and simplicity of the operation. Laminating, though slower and more costly, multiplies the strength and toughness of the cured tool. Combining a laminated face with a cast core gives the advantages of both techniques. Molds may be of wood, plaster, plastics, or metal. Castings can be either open or closed type, depending on the tool. Directions for casting and for laminating the tool are given. Core materials range from foamed phenolic, through filled casting resins, to cast iron or even concrete. Plastics tools, though quite tough, cannot compete with metal in impact strength and durability under rough treatment. The life of metal-forming tools is not predictable; it will depend on the material being formed and the draw characteristics. The life of plastics-forming tools is dependent on the temperatures and pressures used in the plastics-forming process. Die models and prototypes will last indefinitely. In general, the cost of plastics tools is 30 to 70% less than their metal counterparts. The chief plastics used in tooling are epoxies,



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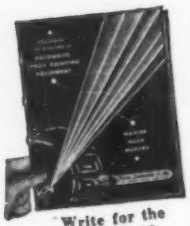

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polyesters, and phenolics. The advantages and limitations of each of these materials are discussed.

NEW HEAT-RESISTANT ADHESIVES FOR METAL BONDING. G. Epstein. Materials and Methods *41*, 107-110 (Jan. 1955). Two heat-resistant adhesives suitable for structural applications at temperatures as high as 600° F. are described. They are based on phenolic resins with alkaline catalysts. A two-stage cure is used for optimum results. The procedure involves air-drying to evaporate practically all solvents, followed by precuring at 180° F. until no longer tacky. The final stage involves curing at 275° F. under pressure. Surface preparations and bonding methods are described. The properties of the adhesive bonds obtained are given, including tensile shear strength, bend strength, flexural strength, peel strength, and fatigue strength. The effects of exposure to various environments are discussed; tensile shear strength was not impaired by immersion in boiling water for 1 hr., or by 10 min. in 25% sulfuric acid-sodium dichromate cleaning solution at 160° F. Lap-shear specimens retained over 80% of their original tensile-shear strength after 5 hr. exposure to 510° F. The new adhesives are being successfully employed in the skin-to-core bonding of aluminum or glass-reinforced plastic sandwich constructions, and in the splicing of honeycomb cores, as well as in numerous non-structural applications where heat-resistance is required.

Properties

CASTING RESINS CONTAINING POLYSTYRENE. ELECTRICAL AND PHYSICAL PROPERTIES OF FN-2.5 AND OTHER RESINS. P. Ehrlich, R. W. Tucker, and P. J. Franklin. Ind. Eng. Chem. *47*, 322-27 (Feb. 1955). Over the temperature range investigated, the alternating current behavior of all the casting resins studied was determined by the response of the dipoles in the polymer to the field. The loss maxima increase with the number of dipoles in the polymer and the square of their moment. When the proportion of interchain bridges introduced by a cross-linking agent, compared to the polar groups responsible for the losses, becomes large enough, the loss maxima can be materially reduced by the further addition of such a cross-linking

agent. The addition of cross-linking agent raised and the addition of plasticizer depressed the temperature at which the loss maxima occurred.

DIFFUSION OF WATER VAPOR IN POLYMERS. F. A. Long and L. J. Thompson. J. Polymer Sci. *15*, 413-26 (Feb. 1955). Studies were made by a sorption-desorption procedure on the diffusion of water vapor at relative humidities of from 30 to 85% into the polymers, polyvinyl acetate, cellulose acetate (37.9% acetyl), cellulose nitrate (12.0% N), 6-10 nylon, and polyvinyl alcohol. Diffusion of water in polyvinyl acetate obeys Fick's law at temperatures of from 30 to 50° C. and also at 22° C., which is below the second-order transition. The energy of activation for diffusion of water into polyvinyl acetate is 15 kcal. per mole and at 40° C. the diffusion coefficient is 7×10^{-6} $cm.^2/min.$; in contrast to the results with organic vapors, the diffusion coefficient for water is found to be independent of concentration of water in the polyvinyl acetate. Similar behavior holds for diffusion of water at 40° C. into cellulose acetate, cellulose nitrate, and 6-10 nylon. The chief difference is that for these three polymers the diffusion departs mildly from Fick's law at the later stages of some of the sorption and desorption experiments. This generally uncomplicated diffusion of water in these three polymers contrasts with the markedly anomalous diffusion found for organic vapors such as methanol and acetone into cellulose acetate and nitrate. With polyvinyl alcohol the diffusion of water is distinctly anomalous and closely resembles the non-Fickian diffusion of organic vapors in cellulose acetate and nitrate. One consequence is that the rate of sorption and desorption of water in polyvinyl alcohol is considerably slower than in the other polymers and is also concentration dependent.

Testing

ULTRA-VIOLET SPECTROPHOTOMETRIC DETERMINATION OF STYRENE AND PHTHALATE AND FUMARATE ESTERS IN POLYESTER RESINS. R. C. Hirt, R. .G Schmitt, and R. W. Stafford. Analytical Chem. *27*, 354-56 (Mar. 1955). Unsaturated polyester formulations, consisting of polymeric esters of dihydric alcohols and dibasic acids dissolved in a vinyl monomer such as styrene, may be analyzed spectrophotometrically without prior chemical treatment or separation. Phthalate ester and styrene concentrations are determined spectrophotometrically, and the fumarate and/or maleate ester concentration is calculated from relations existing among the components and is used as a correction for the phthalate and styrene concentrations. This method can be of value in the rapid checking of formulations against established specifications.

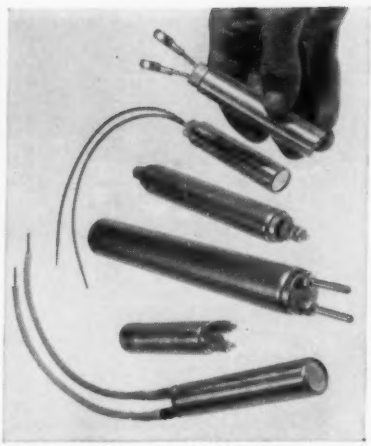
ISOPIESTIC METHOD FOR DETERMINING MOLECULAR WEIGHTS OF POLYMERS. R. L. Parrette. J. Polymer Sci. *15*, 447-58 (Feb. 1955). The methods generally used for determination of the molecular weight of polymers cannot ordinarily be used for molecular weights between 1000 and 30,000. This is the range most suitable for determination by the isopiestic method, whereby the molecular weight is measured by comparing the vapor pressure of the polymer solution with that of a solution containing a reference solute.

Chemistry

POLYMERIZATION OF VINYL ACETATE AT LOW TEMPERATURES. G. M. Burnett, M. H. George, and H. W. Melville. J. Polymer Sci. *16*, 31-44 (Mar. 1955). The polymerization of vinyl acetate was studied at temperatures down to —40° C. by means of a specially designed apparatus. The object of the experiments was to prepare polyvinyl acetates of as linear a character as possible by working at low temperatures in order to avoid transfer reaction to accumulating polymer. Polymers prepared at a number of temperatures were examined osmotically and by the light scattering technique. Using the latter technique, it is shown quite clearly that the size of the molecules, as measured by the dissymmetry measurements, gets smaller and smaller for a given molecular weight as the temperature of synthesis is decreased. It is believed that if the synthesis is carried out at temperatures below —30° C., then the molecules formed are predominantly linear in character.

POLYMERIZATION OF METHYL METHACRYLATE BY PULSES OF HIGH-ENERGY ELECTRONS. T. G. Majury. J. Polymer Sci. *15*, 297-304 (Jan. 1955). Methyl methacrylate, vinyl acetate, styrene, and diethylene glycol-bis (allyl car-

(*To page* 164)



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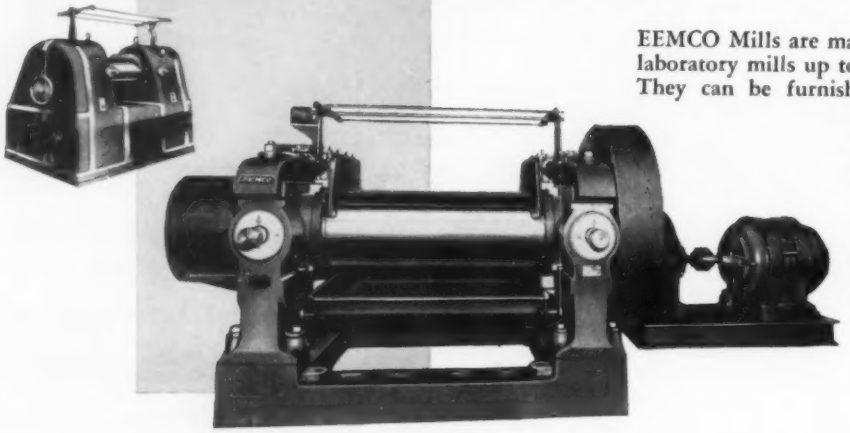

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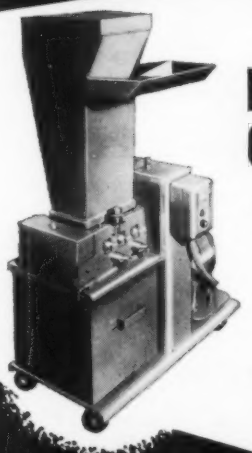

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bonate) were subjected to irradiation by very intense microsecond pulses of electrons of 3 m.e.v. energy. The methacrylate underwent a prolonged, slowly decaying polymerization beginning immediately after irradiation; in a typical run, a dose of 1.5×10^5 rep delivered in 12 pulses resulted in 1% polymerization after 6 hr. and 5% polymerization after 50 hours. The extent of polymerization was reduced by increasing the surface of glass in the reaction vessel. Freezing the monomer during irradiation reduced the extent of subsequent polymerization in the liquid state by approximately 40 percent. Evidence was obtained to show that the polymerizing radicals are of the normal type found in thermal and photochemical work, and that their initiation is attributed to the formation of a catalyst during or immediately after irradiation. No significant amount of polymerization was observed to take place in the other monomers.

RING OPENING IN LACTAM POLYMERS. A. Conix and G. Smets. J. Polymer Sci. *15*, 221-29 (Jan. 1955). Apparent first-order rate constants and activation energies for the alkaline hydrolysis of polyvinylpyrrolidone, polylactam, vinylpyrrolidone-maleic acid copolymer, *N*-isopropyl-γ-valerolactam, butyrolactam, and pyrrolidone-*N*-acetic acid were determined in order to study the influence of structure on the stability of the lactam ring. It was found that the behavior toward alkaline hydrolysis of polyvinylpyrrolidone closely resembles that of its low molecular analogue *N*-isopropyl-γ-valerolactam. It is shown that a carboxyl function substituted near the lactam ring has a favorable influence on the ease of hydrolysis. Alkyl substitution on the lactam nitrogen, however, makes the lactam more resistant against hydrolysis.

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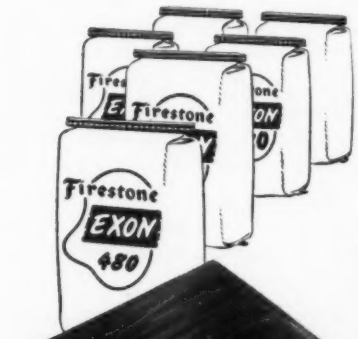

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SOLUTIONS. E. J. Kowolik and J. G. N. Drewitt (to British Celanese). U. S. 2,706,185, Apr. 12. Solutions of acrylonitrile polymers.

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RESIN. J. K. Dixon and N. T. Woodberry (to American Cyanamid). U. S. 2,706,718, Apr. 19. Treating cellulosic material with guanamine resins.

POLYETHYLENE. R. G. Newberg, H. W. Wilson, and A. F. Sayko (to Esso Research). U. S. 2,706,719, Apr. 19. Polyethylene-wax compositions.

INTERPOLYMERS. J. R. Caldwell (to Eastman Kodak). U. S. 2,706,720-1, Apr. 19. Interpolymers of acrylonitrile with amides, imides, and esters.

POLYESTERS. J. R. Caldwell (to Eastman Kodak). U. S. 2,706,722, Apr. 19. Anhydrous linear polyesters.

WATER REPELLENT. S. L. Bass (to Dow Corning). U. S. 2,706,723-4, Apr. 19. Siloxanes for treating masonry.

POLYMERS. C. C. Unruh and C. F. H. Allen (to Eastman Kodak). U. S. 2,706,725, Apr. 19. Polymers of vinyl benzal acetophenones.

POLYMERS. R. D. Evans and M. J. Rhoad (to Goodyear). U. S. 2,706,726, Apr. 19. Reacting a mercapto polymer with a polycarboxylic amide.

COPOLYMERS. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U. S. 2,706,727, Apr. 19. Copolymers of trifluoroacetamides.

POLYMERS. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U. S. 2,706,728, Apr. 19. Polymers of alpha-fluoroacylaminomethyl acrylonitriles.

DIES. L. E. Frost and G. B. Lewis (to North American Aviation). U. S. 2,706,832, Apr. 26. Plastic laminated die.

MOLDING. R. O. Davis (to Gene Olsen). U. S. 2,706,843, Apr. 26. Molding plastic building blocks.

FLEXIBLE HOSE. C. H. Beare, S. R. Carson, and R. L. Monbeck (to General Motors). U. S. 2,707,017, Apr. 26. Wire-reinforced plastic tubing.

HEAT SEALING. D. G. Bolton (to Du Pont). U. S. 2,707,018, Apr. 26. Heat sealing device.

FLOOR COVERING. G. W. Stanton and T. C. Spence (to Dow). U. S. 2,707,157, Apr. 26. Vinyl floor tile.

JOINING. J. Stern. U. S. 2,707,161, Apr. 26. Joining complementary portions of hollow thermoplastic article.

RESINS. R. A. Skiff and R. W. Finholt (to General Electric). U. S. 2,707,177, Apr. 26. Epoxy-triallyl cyanurate resins.

VINYL CHLORIDE. J. E. Wilson (to Carbide and Carbon). U. S. 2,707,178, Apr. 26. Stabilizers for polyvinyl chloride.

MOLDING COMPOSITION. P. P. Peyrot and L. J. Dumoulin (to Societe des Usines Chimiques). U. S. 2,707,179, Apr. 26. Organo-polysiloxane compositions.

BATTERY SEPARATOR. G. H. Fernald and K. M. Enloe (to Richardson). U. S. 2,707,201, Apr. 26. Thermoplastic battery separator.

INSULATION. C. D. Richardson and A. F. Zavist (to General Electric). U. S. 2,707,204, Apr. 26. Resin-bonded mica sheet.

INSULATOR. J. F. S. Abbott and C. W. Otto (to U. S. Rubber). U. S. 2,707,205, Apr. 26. Plastic-insulated conductor.

TOY TRACK. A. N. Smith (to Louis Marx). U. S. 2,707,606, May 3. Molded plastic train track.

MOLDING POWDER. S. Siddiqui, K. K. Sarin, and J. P. Varma (to Council of Scientific and Industrial Research). U. S. 2,707,686, May 3. Molding powders from shellac and bhilawan resins.

COATING. H. E. Wilde (to Merck). U. S. 2,707,689, May 3. Allyl starch compositions.

ADHESIVE. J. R. Standring. U. S. 2,707,694, May 3. Bonding wood, metal, and plastic.

BLOWING AGENT. H. F. Schwartz (to Sherwin-Williams). U. S. 2,707,707, May 3. Biuret-urea blowing agent.

RESINS. H. Wittcoff (to General Mills). U. S. 2,707,708, May 3. Solutions of polyamide and epoxy resins.

MOLDING COMPOSITIONS. R. Buchdahl and M. Baer (to Monsanto). U. S. 2,707,709, May 3. Non-electrostatic molding resins.

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Injection Molding Machine—Two models in a line of injection machines are said to provide the plasticizing capacity and locking pressures necessary for the production of large molded pieces with uniform wall thickness. A long stroke for deep-draw molding is also incorporated. All hydraulic valves are mounted on a single, centrally located panel for easy inspection and minimum maintenance. A four-pass oil cooler is claimed to provide economy of cooling water. The units are equipped with automatic compensating weigh-feed, 100-lb. hoppers, automatic timing controls, three Wheelco proportioning-type pyrometers, front and rear safety controls, and hydraulic pumps with 40 gal./min. capacity at 200 p.s.i.

Specifications for the two models follow:

	12-oz. machine
Injection capacity (oz./shot)	12
Plasticizing capacity (lb./hr.)	125
Pressure on material (p.s.i.)	20,000
Size of die platens (in.)	32 by 32
Mold opens (in.)	8 to 14
Maximum die height (in.)	22
Minimum die height (in.)	8
Rated casting area (sq. in.)	165
Motor size (hp.)	30
Dimensions (in.)	215 by 47 by 95 high

Specifications for the 16-oz. machine are identical to those given above for the 12-oz. press. The 16-oz. model differs from the 12-oz. machine in diameter of injection plunger, diameter of hydraulic injection cylinder, speed of injection plunger, and time required for injection stroke. *Lombard Governor Corp., Ashland, Mass.*

Interchangeable Heating Cylinder—A new, extra-capacity replacement heating cylinder can be fastened directly to H-P-M injection machines, or fitted to Reed-Prentice machines by means of a special adaptor. The cylinder is rated at 35 kw. and is reported to be virtually free of maintenance costs. Designed for maximum plasticizing capacity with minimum heat density on internal areas, the interchange unit is said to minimize degradation of material and other results of overheating. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

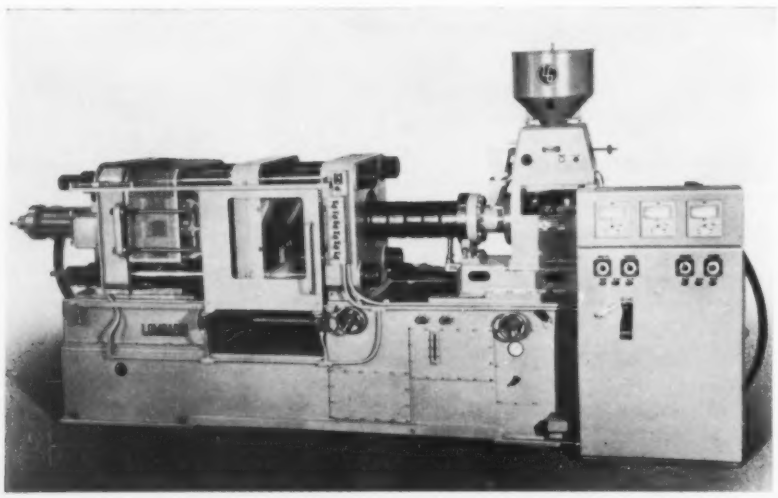
Heating Element—Cartridge heating unit, designated Firerod, is claimed to produce five times more heat than any standard unit of similar size and to have a longer life. This performance is due to the design of the element in which the difference in temperature between resistance wire and dissipating surface has been kept to a minimum.

Elements are available in standard, moistureproof, and special units, in sizes from 1¼- to 12-in. lengths and ⅜- to ½-in. diameters. *Watlow Electric Mfg. Co., 1376 Ferguson Ave., St. Louis 14, Mo.*

Hydraulic Press—Model 3A seifcontained, all-purpose hydraulic press is designed for heavy production schedule requirements. The machine has a heavy-duty platen and platen-guide assembly, automotive-type piston rings on the ram head, and special packing, and utilizes a power return. Available in 50-, 100-, 150-, and 300-ton capacities, the press comes with a Unitrol unit, a single control assembly said to eliminate piping and plumbing and to provide single control for operation. Optional equipment available includes either steam-cored or electrically heated platens, and a semi-automatic device for presetting time cycles. *Clifton Hydraulic Press Co., 288 Allwood Rd., Clifton, N. J.*

Duplicator—Milling machine designated Velvetrace is said to be capable of accurately reproducing the finest details of virtually any three-dimensional model. The duplicator has a work capacity of 12 by 9 inches. The tracer point follows the model without mechanically touching it.

Basic to the system is a minute spark gap between tracer and model, across which is applied a harmless high-voltage, low-amperage current. The surface of the model to be reproduced is made electrically conductive and grounded to the machine. Changes in contour produce changes in gap which in turn produce proportional changes in the voltage across the gap. This voltage is amplified and used to control the magnetic clutches which drive the spindle quill and the transverse motions of the table. Each drive has a pair of magnetic directional clutches which are always driving and slipping. Neither ever engages to the extent of not slipping nor disengages to the extent of not driving. This



Lombard Governor's injection molding machines have long stroke for deep-draw molding

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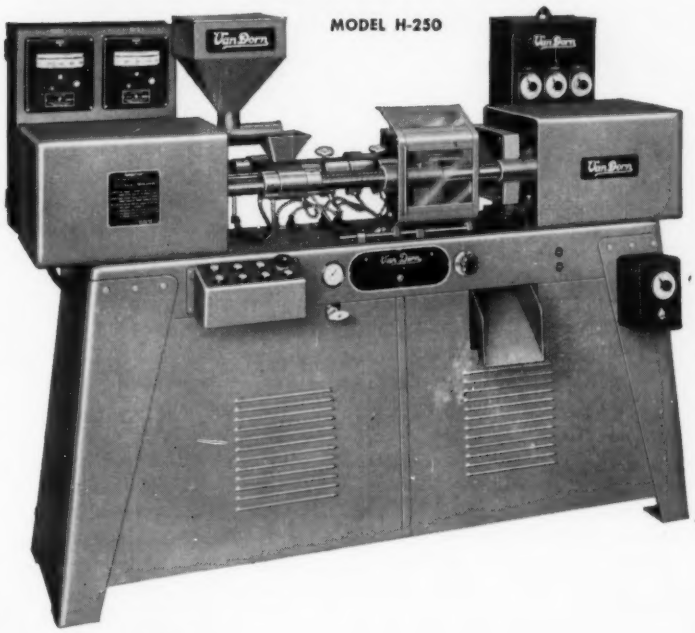
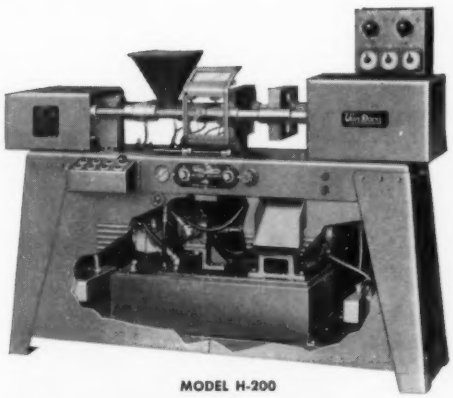
This high speed 2½ oz. injection press plasticizes material at 22 lbs. plus per hour, and attains up to 720 cycles per hour (dry run). High efficiency due to *water cooled* plunger, transfer hopper, and oil cooler. Accessible platen clamp device insures easy purging to change material. For safety, press will not operate unless part is fully ejected. Simple operation due to automatic, adjustable material metering device. Press requires little attention during production. May also be operated semi-automatically. All steel construction.



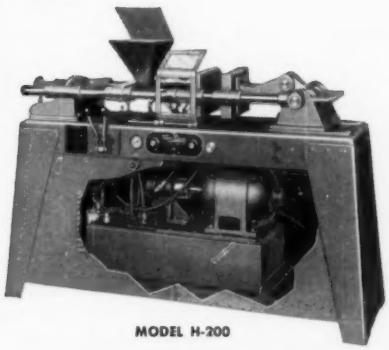
MODEL H-250



MODEL H-200

SEMI-AUTOMATIC 2 OZ. PRESS

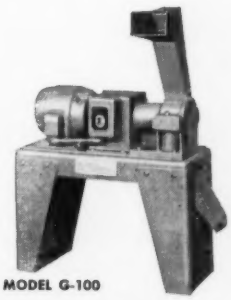
Up to 10 cycles per minute. Safe, simple push button controls. Accurate temperature regulation. Rugged, compact, quiet.



MODEL H-200

POWER OPERATED, LEVER CONTROLLED PRESSES

2 oz. or 1 oz. Operate 8 hours for under a dollar and use inexpensive molds. Easily set up in twenty minutes.



MODEL G-100

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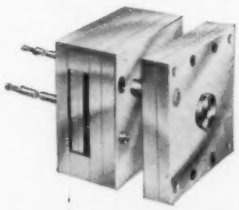

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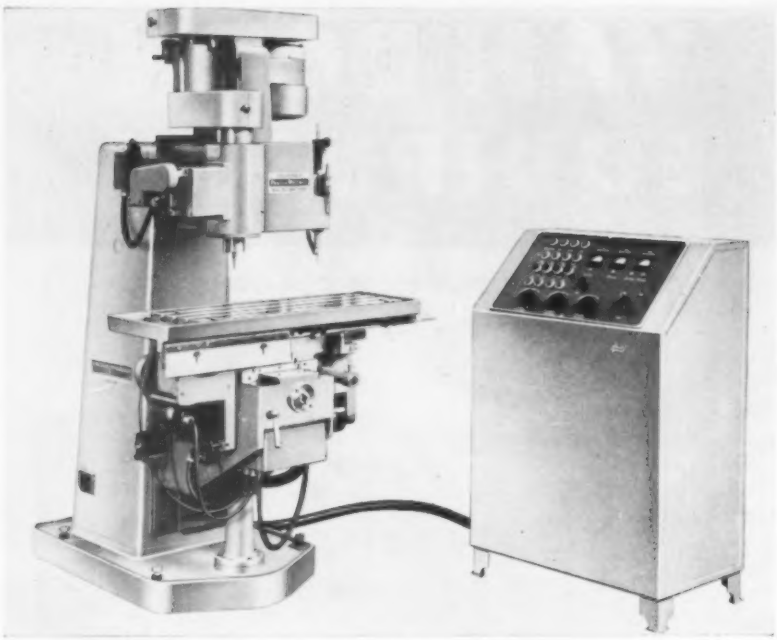


Pratt & Whitney's Velvetrace milling machine accomplishes duplication by using tracer point that follows contours of model to be reproduced without mechanically touching it

arrangement is said to assure extremely accurate milling.

Operation of the machine is fully automatic. The table is set to travel in a series of passes, step-feeding the cross slide at the end of each pass. The cutter spindle quill roll-feeds on preloaded ball bearings.

The Velvetrace has spindle speeds ranging from 310 to 10,800 r.p.m. *Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford 1, Conn.*

Fasteners—Series C7000 flat-type Speed Nuts, low-cost, self-locking fasteners, can now be applied to either "A" or "B" (Z) sheet metal screws. Speed Nuts operate on the principle of spring tension fastening. Spinning freely down the screw threads, a base arch on the Speed Nut flattens with one or two final turns of the screwdriver, giving an "arched spring lock." At the same time, the fastener's prongs are forced into the roots of the screw threads to create an "inward thread lock." *Tinnerman Products, Inc., P. O. Box 6688, Cleveland 1, Ohio.*

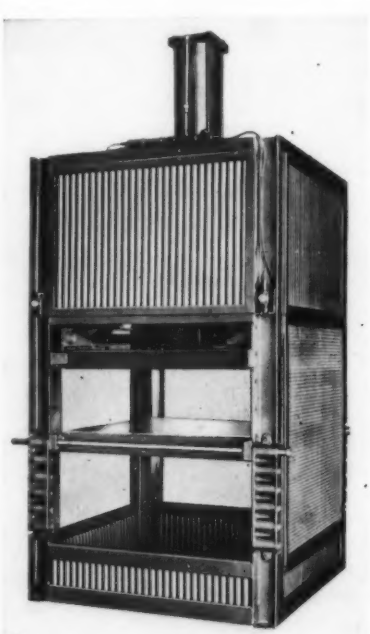
Cartridge Heaters—Spring strain relief protects electric cartridge heating units from premature lead wire breakage which may result from the up-and-down movement of platens and dies used in many plastics processing applications. A high-tensile spring is mechanically locked to the cartridge heating unit and supports the lead wire, preventing breakage of lead wires because of sharp twists. Spring is claimed to retain its flexibility under all operating conditions and not to be affected by heat. Electric cartridge heating units equipped with spring strain relief are supplied in ⅜-, ½-, ⅝-, and ¾-in. diameters in conventional lengths and wattages. *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

Emergency Kit—Parts necessary to change high-pressure piping on injection machines to vibration-free high-pressure connections are included in this kit, which comprises a complete range of sizes from ¼ to 2 in., with working pressures from 4500 p.s.i. for the ¼-in. size to 2000 p.s.i. in the 2-in. size. Adaptors, including 45-, 90-, and 180-degree swivel adaptor unions in male and female dry seal iron pipe thread are available. *Elgood Materials Corp., 372-80 Ten Eyck St., Brooklyn 6, N. Y.*

Scrap Grinders—Beside-the-press plastics scrap grinders are claimed to grind polyethylene without fluffing. Embodying fully enclosed design, the machines are available in the following models: Model 3C-1—3-hp. motor, throat 6½ by 12 in., dimensions 34½ by 30 by 60½ in. high; Model 2A—1½-hp. motor, throat 5½ by 8 in., dimensions 29¾ by 23½ by 52 in. high; and Model 1A-1—¾-hp. motor, throat 3¾ by 5 in., dimensions 25 by 20½ by 46 in. high. *Foremost Machine Builders, Inc., 52 Vanderbilt Ave., New York 17, N. Y.*

Test Instrument—Sonic analyzer for non-destructive testing of solid and visco-elastic materials measures natural or induced deterioration, product uniformity, and other characteristics. It is a self-contained instrument, designed for laboratory use, field testing, or production quality control. The instrument tests plastics, glass, metals, carbon, rubber, adhesives, and other materials. *Kinetic Instrument Co., Highland Park, Ill.*

Trimming Machine—Plastics die press for cutting or trimming formed plastic sheet is claimed to be a fast operating unit for high production volume of thin plastics sheet die cutting. The unit exerts 60-ton pressure and has daylight opening of 15



Abbott Plastic Machine's die press is designed for high-volume die cutting and trimming of thin, formed sheet

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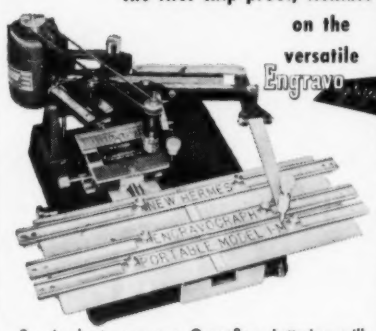

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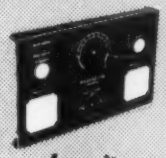

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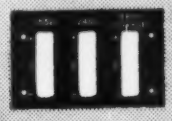

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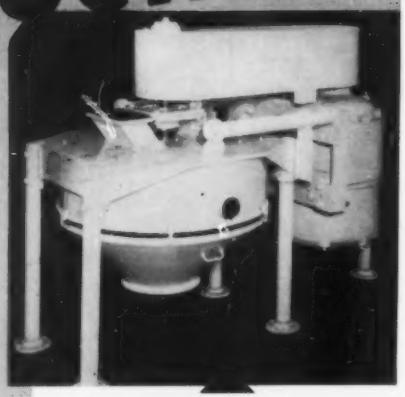

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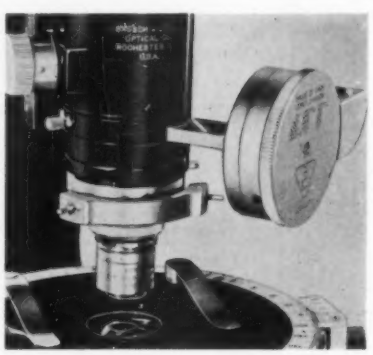
inches. Cutting table is 9 sq. feet. Air-operated and controlled, the machine is said to be capable of cutting 500 lineal inches of 0.080-in. material. *Abbott Plastic Machine Corp., 6322 N. Clark St., Chicago, Ill.*

Inspection Tool—Known as an accessory slot compensator, this microscope accessory measures strain in plastics and glass containers.

The first step in measuring strain with the instrument is the measurement of birefringence. Determination charts are then used to obtain readings. Determinations to $\pm 2\%$ without calibration are read directly in millimicrons from a scale engraved on a rotating drum. No computations or conversion tables are needed. The instrument performs with greatest efficiency when used with light having a wavelength of 5890 Angstroms. To obtain this light value, an interference filter is available for use with tungsten illuminators. Retardations from 0 to 2700 millimicrons can be measured with the slot compensator. Scale division values engraved on the side of the instrument provide a permanent record and a means of ready reference. *Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y.*



Bausch & Lomb's slot compensator (shown attached to microscope, right) measures degree of strain in plastics

Sheeter, Bag Maker—The LectrOmatic plastic film sheeter and bag maker automatically measures, cuts, and dispenses all types of plastic film and other wrapping materials. Material is fed from roll stock. The same unit vends flat sheets or will vend from tubular stock to make bags at a rate of up to 3600 bags per hr., depending on length of bag. The

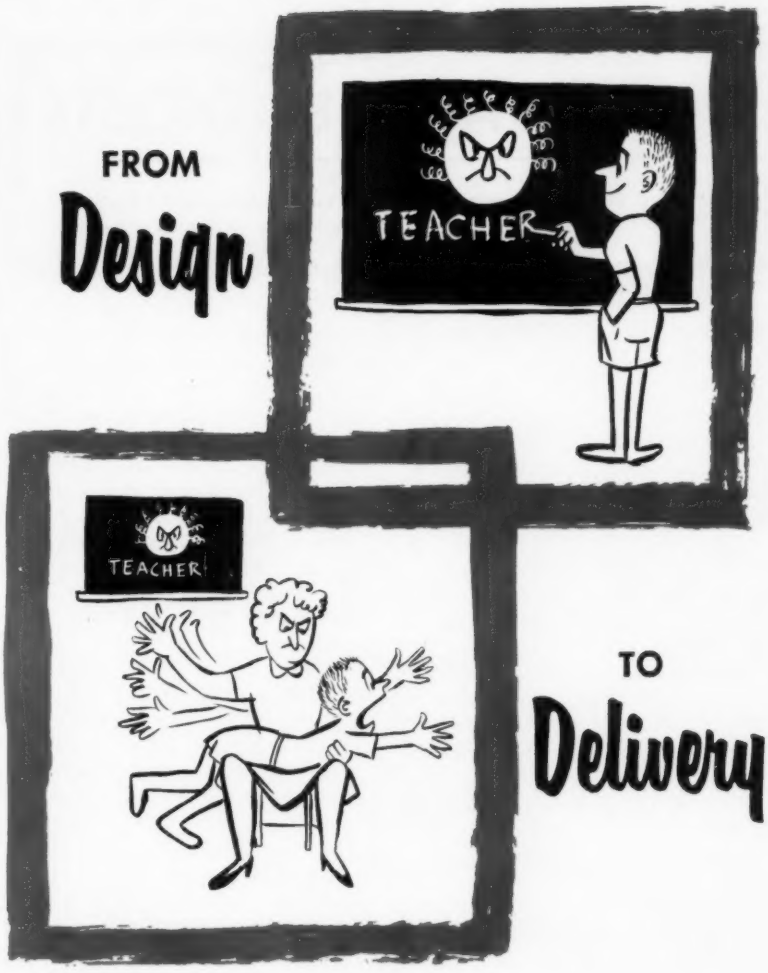
machine handles up to 22 in. wide rolls and vends sheet or bags in a choice of 56 different lengths from 4 to 31½ inches. Face plate-type heat sealers for manual sealing of packages can be positioned at right end of table, flush mounted, and are optional at extra cost. The machine may also be equipped with electric eye control for cutting printed stock using register marks as guide for length dimension. The equipment is interchangeable for running sheets or bags without changes or adjustments. *LectrOmatic Devices, Inc., 3349 W. Addison St., Chicago 18, Ill.*

Temperature Meter—Multi-point temperature indicator permits a single operator to take quick readings of the temperatures at different locations while remaining in one place. The unit consists of different thermocouples, each at a different location, connected to a high-resistance pyrometer that is equipped with a selector.

Pyrometer, selector switch, and terminal strip are all enclosed in a single cabinet, designed for flush or surface mounting. Calibrating spools of wire may also be used, if needed, to compensate for widely varying distances to the various thermocouples. Five models are available with 3, 5, 11, 17, and 23 selector positions, respectively. *West Instrument Corp., 525 N. Noble St., Chicago 22, Ill.*

Diffusion Pump—High-vacuum pump (Model H-10-P) for moderate-size vacuum systems is a 10-in. diameter fractionating diffusion pump which is said to be also usable as a booster pump. When using Narcoil-40 pump fluid, the pump will handle 1700 l./sec. in the pressure range from 5×10^{-4} to 5×10^{-5} mm. of mercury and has a throughput of 3800 l./sec. at 10 microns. It blanks off below 1×10^{-6} mm. of mercury and has a maximum tolerable fore-pressure of 200 microns.

Model H-10-P operates as a booster pump when Narcoil-10 is used as pumping fluid. Pumping speed at 1 micron is 200 l./sec., and the pump has a throughput of 6000 l./sec. at 10 microns. Blankoff is better than 1.5×10^{-4} mm. of mercury and maximum tolerable fore-pressure is 400 microns. *Naresco Equipment Corp., 160 Charlemont St., Newton Highlands 61, Mass.*



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"Cellulose Nitrate," by Frank Douglas Miles

Published in 1955 by Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. 422 pages. Price: $7.00.

This volume, of interest to both the industrial user of cellulose nitrate as well as the academic researcher, aims at surveying the principles underlying the manufacture and uses of this group of chemicals, as well as the experimental work that has been carried out in connection with it.

Following an introductory chapter which surveys the chemical and physical constitution of cellulose, the subject of nitration is covered in detail. Succeeding chapters deal with the physical and chemical reactions of the nitrates and with gels containing them (used in plastics compositions, explosives, and other applications). The final chapters deal with solvents, gelatination and solution, and the physical properties of dilute and concentrated solutions of nitrates. The literature is fully discussed and several hitherto unpublished research reports are made available.

"France-Plastiques"

Published in 1955 by Société de Créations Éditions et Productions Publicitaires, 27, Rue Laffitte, Paris IXe, France. 976 pages. Price: 2700 F. (ca. $8.20).

The seventh (1955) edition of the annual yearbook covering the French plastics industry is a classified guide encompassing materials makers, machinery and equipment manufacturers, molders, and fabricators. Lists of importers and distributors are also included. Indices of trademarks, manufacturers' societies, educational institutions, and publications are given.

"The Hard-Surface Floor-Covering Industry," by Robert F. Lanzillotti

Published in 1955 by State College of Washington Press, Pullman, Wash., 204 pages. Price: $4.00.

In what is probably the first work to assemble comprehensive data on the hard-surface floor-covering industry is included an analysis of seller concentration, pricing practices, price determinants, and interfirm price relationships. Profits, investments, factors influencing location of producers, conditions of entry into the industry, and trends in production and consumption are examined in detail. Certain projections and an evaluation of the industry outlook for the future are presented.

Reagents — Catalog and price list covers over 100 reagents, giving analytical uses and prices for each. *Dajac Laboratories, Chemical Div., The Borden Co., Leominster, Mass.*

X-ray equipment—Two pieces of literature cover the use of X-ray equipment in industry: Four-page bulletin "Norelco MG 60" gives design details and application data on a new lightweight portable X-ray unit for radiographic and fluoroscopic work in laboratories and industrial plants. One-page reprint "Sperry Gyroscope Employs X-Ray for Development Problems" describes how that company has reduced time and effort when radiographing many varieties of electrical and electronic equipment. *Control Instruments Div., North American Philips Co., Inc., 750 S. Fulton Ave., Mount Vernon, N. Y.*

A.S.T.M. proceedings—Technical accomplishments of the American Society for Testing Materials for the year 1954 are summarized in the 1954 edition of the A.S.T.M. Proceedings. Included in the 1400-page volume is the summary of the Proceedings of the 57th Annual Meeting, held in June 1954, listing by title and author the program for each of 36 sessions. Reports of the 68 technical committees and 37 technical papers and discussions on a wide variety of subjects pertaining to research and testing of materials are included. In addition to the papers and reports embodied in the Proceedings, there are listed in the table of contents all symposiums published separately as Special Technical Publications (STP's) and all papers published in the A.S.T.M. bulletin. The Proceedings contain much discussion that has been submitted and not previously published. $12.00. *American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.*

Synthetic ammonia — How high yields, low operating costs, and flexibility of plant design can be obtained in the production of synthetic ammonia is the subject of this 12-page booklet. The booklet details purification methods and Kellogg Process conversion employed in conjunction with steam methane reforming under pressure, using natural refinery gases of low H_2 content, and coke oven gases; catalytic partial oxidation, using gaseous hydrocarbon feed materials and oxygen enriched air; non-catalytic partial oxidation, using natural gases or residual fuel oils; and low-temperature raw gas conversion, employing high H_2 content feed gases without reforming or partial oxidation. Flow diagrams illustrate each basic type. Initial plant investment costs, as well as complete operating costs, are given. *The M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.*

Timers — Eight-page catalog illustrates and describes a variety of mechanical, electrical, and electronic devices for timing and counting. Included in the listing are electric stop clocks, high-speed impulse counters, and printing timers suitable for industrial and laboratory applications. *C. H. Stoelting Co., 424 N. Homan Ave., Chicago 24, Ill.*

Chemical industry—"The Chemical Industry Facts Book" provides an over-all survey of the operations of the chemical industry in the United States. It covers such topics as the growth of the industry, its distinctive characteristics, raw materials used, personnel employed, plants, finances, and research and development facilities. There is a section on chemicals in everyday life (for health, crops, clothing, defense, and others), and another dealing with the activities of the Manufacturing Chemists' Association. Membership

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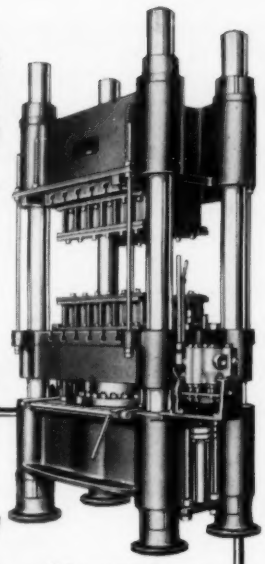

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list of the MCA, trade and professional associations, and a selected bibliography are also included. $1. *Manufacturing Chemists Association, 1625 Eye St., N. W. Washington 6, D. C.*

Rubber rolls—Up-to-date information concerning numerous phases of rubber roll manufacture, characteristics, applications, operation, and maintenance are contained in this 60-page brochure. Topics covered include: what is rubber, how rubber rolls are made, density or hardness of rubber, how thick should a rubber covering be, crowning and tapering of rubber rolls, balancing of rolls, care of rubber rolls, regrinding, factors affecting the nip action of rubber squeeze rolls, and others. $2.00 *Rodney Hunt Machine Co., Orange, Mass.*

Paint resin—Properties and compatibilities of Alpex, a hard synthetic resin based on caoutchouc hydrocarbon polymers, are outlined in this bulletin. The resin finds application in the formulation of printing inks and protective coatings, and is supplied in 100% solids form or as a 60% solution. A section on the properties of Alpex film is included. *Alkydol Laboratories, Inc., 3242 S. 15th Ave., Cicero 50, Ill.*

Styrene—Up-to-date wall chart lists comparative data on the properties of a line of molding materials. Recommended applications are also shown. *Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.*

Grinders—Catalog describes complete line of Pulva-Sizers, Com-Bin feeders, and auxiliary equipment. *Pulva Corp., 550 High St., Perth Amboy, N. J.*

Pneumatic accessories—Two booklets describe, respectively, a power drive cylinder and several pneumatic-hydraulic transmission systems and components. Bulletin IC-2.3 gives data on the NP power drive cylinder which operates on 500 p.s.i. maximum (oil) or 200 p.s.i. maximum (air). Bulletin IC-2.2 contains details on a line of pneumatic-hydraulic actuators and controls available for industrial production machinery. These include power transmission systems, the power drive cylinder mentioned above, power check regulator, and various valves, including relay, quick exhaust, pushbutton-, foot-, hand-, and pilot-operated control valves. *Industrial Actuators and Controls Div., National Pneumatic Co., Inc., 125 Amory St., Boston 19, Mass.*

Propylene glycol—Data on physical and physiological properties, specifications, shipping containers, constant-boiling mixtures, solubilities, and applications of propylene glycol are presented in folder F-8738. The chemical is an important raw material for polyester resins; an intermediate for plasticizers; and a solvent and humectant widely used in foods, cosmetics, and pharmaceuticals. It is also used as an antifreeze, a lubricant, and a component of hydraulic fluids. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Vinyl resins—Procedures for stabilizing vinyl resins are described in this 24-page technical bulletin. In

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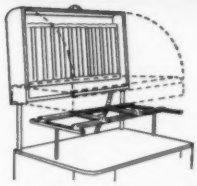

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addition, 14 different stabilizers are described and property and application data are given. *Witco Chemical Co., 122 E. 42nd St., New York 17, N. Y.*

Acetate emulsions—Two bulletins deal, respectively, with polyvinyl acetate emulsion CL-100 (NP-12) and polyvinyl acetate copolymer emulsion CL-202 (NP-14), both used for latex paints. *Celanese Corp. of America, Plastics Div., Market Development Dept., 290 Ferry St., Newark 5, N. J.*

Polyethylene—This booklet gives general information and a chemical description of polyethylene resins; method of production of Petrothene polyethylene from hydrocarbon raw materials; and data on properties, uses, means of processing, and fabricating. *U. S. Industrial Chemicals Co., Div. of National Distillers Products Corp., 99 Park Ave., New York 16, N. Y.*

P.V.C.—Service Bulletin 38 gives data on mechanical, thermal, electrical, and other properties of Exon 402-A, a polyvinyl chloride resin specifically designed for unplasticized vinyl applications. A summary of physical properties of unplasticized Exon 402-A laminate, immersed in over 50 chemicals for various lengths of time, is included. *Firestone Plastics Co., Div. of The Firestone Tire & Rubber Co., Pottstown, Pa.*

Automation—"Methods, Manpower, and Machines" explains how any business, from smallest to largest, can make use of automatic office equipment. Services available to business and industry in automating their office work are outlined. Case histories are given. *Statistical Tabulating Co., 53 W. Jackson Blvd., Chicago 4, Ill.*

Alkali chemicals—The fourth edition of "The Story of the Chemicals You Live By" represents a primer on basic alkali chemicals and coproducts, and their derivatives or related special-purpose materials; it also represents a survey of the principal applications of these products. Covered are soda ash, caustic soda, chlorinated methanes, bicarbonate of soda, sodium silicates, calcium carbonates, chromates, specialized chemicals, organic chemicals, plastics, and agricultural chemicals. *Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14 Ohio.*

Hot-die stamping—"Color Brand Your Products for Life" discusses the trademarking, decoration, and identification of products by hot-die stamping. Over 100 product applications are listed. The hot-die method of product marking; types of stamping equipment; and the uses of gold, bronze, aluminum, and pigment colors on plastics, paper, wood, leather, cloth and other materials, are discussed. *M. Swift & Sons, Inc., 10 Love Lane, Hartford 1, Conn.*

Shielded rooms—Catalog presents engineering and application data on a line of r.-f. shielded enclosures. Screened and sheet metal standard enclosures are covered individually, with insertion loss or attenuation curves for each room, and construction details. Engineering specifications and standard room sizes

available are given. Application information is included. *Ace Engineering & Machine Co., 3644 N. Lawrence St., Philadelphia 40, Pa.*

Vacuum metallizing—Catalog 551 describes a line of metallizing units for production and experimental work. Included is a description of the vacuum metallizing process. *High Vacuum Equipment Corp., 349 Lincoln St., Hingham, Mass.*

Oleic acids—This 20-page brochure covers various means of evaluating oleic acids, with emphasis on end-product performance. A section on handling oleic acid, an end-product selection chart, and a series of property charts are included. *Emery Industries, Inc., Dept. 5, Carew Tower, Cincinnati 2, Ohio.*

Draftsmanship—"Simplified Drafting," presents 11 common sense rules for simplifying drafting practices. Through the medium of sample drawings of engineered parts and assemblies, the 11 rules—from the use of word descriptions for simple parts to making free-hand drawings wherever possible—are illustrated and a comparison made between traditional and simplified methods. *American Machine & Foundry Co., General Engineering Laboratory, 11 Bruce Pl., Greenwich, Conn.*

Motor control—Eight-page booklet presents a line of Servospeed motor speed control models, including $\frac{1}{50}$- to ½-hp. half-wave models and ¼- to 3-hp. full-wave models. Suggested uses include automatic take-up for plastic and textile processing, textile inspection, and others. Specifications and dimensions are included. *Electro Devices, Inc., 4-6 Godwin Ave., Paterson 1, N. J.*

Heating cylinder—This booklet describes a line of replacement heating cylinders, giving details of design and construction. Data on installation, operation, and maintenance are included. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Boosters—Double-acting reciprocating boosters are illustrated and described in this four-page pamphlet. The pamphlet illustrates a basic circuit, two rapid pressure build-up circuits, two slow pressure build-up circuits, and mounting and dimensional data covering these boosters in 4-, 5-, 6-, 8-, 10-, 12-, and 14-in. bores in 1- through 5½-in. diameter rams. *Miller Fluid Power Co., 2040 N. Hawthorne Ave., Melrose Park, Ill.*

Polyester resins—This folder contains technical information on the properties of a line of rigid, flexible, and resilient Plaskon polyester resins. When reinforced with fibrous glass, these resins form high-strength laminates used in car and truck bodies, luggage, corrugated panels, boat hulls, and other applications. *Barrett Div., Allied Chemical and Dye Corp., 40 Rector St., New York 6, N. Y.*

Tumbling barrels—Bulletin LS-55 describes and illustrates dry-process tumbling barrels for large-scale finishing operations, including deburring and polishing. Recommendations for selecting specific abrasive compounds and informa-

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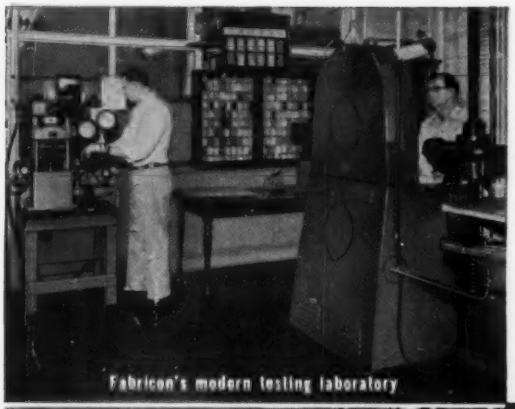

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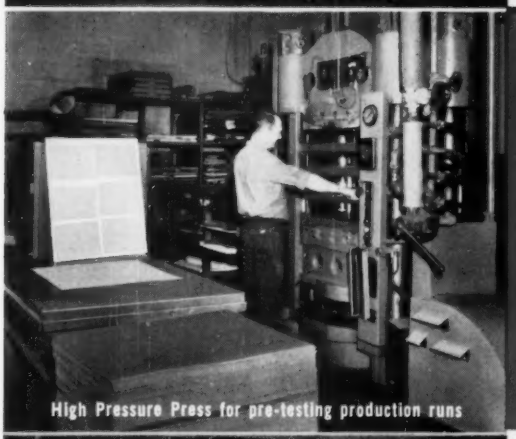

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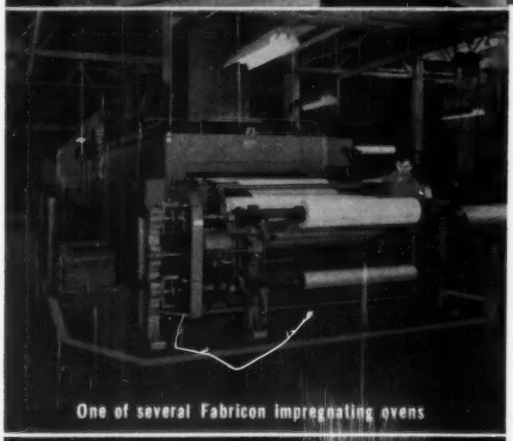

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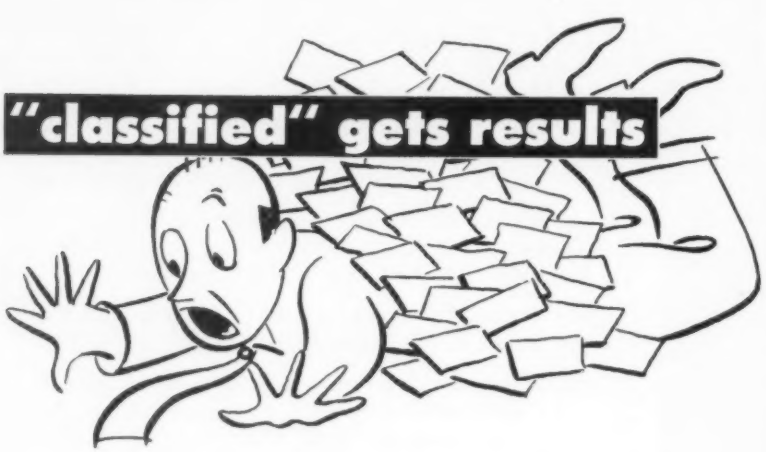

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tion on barrel sizes, drives, controls, liners, and optional equipment are presented. *Tumb-L-Matic, Inc., 4510 Bullard Ave., New York 70, N. Y.*

Isophorone — Physical properties, specifications, shipping data, general solvent properties, constant-boiling mixtures, physiological properties, and uses of isophorone are discussed in Technical Bulletin F-5897A. Isophorone is a solvent for most synthetic resins, including cellulose acetate, cellulose acetate butyrate, cellulose nitrate, ethyl cellulose, vinyl chloride-acetate, and the vinyl butyral polymers. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Phenolic for tooling—Six-page brochure (Product Data, No. 107) covers applications, properties, characteristics, and handling instructions for R-72S phenolic tooling material. Also included is a flow chart outlining typical procedures of Toolplastik fabrication. Application notes are given. *Rezolin, Inc., 5736 W. 96th St., Los Angeles 45, Calif.*

Dispersions — Revised four-page booklet lists 44 colloidal and semi-colloidal dispersions, including operational and mold-release lubricants, dispersions of graphite, molybdenum disulfide, mica, vermiculite, zinc oxide, and acetylene black. Carriers and diluents are given for each product, along with typical applications and physical data. *Acheson Colloids Co., Div. of Acheson Industries, Inc., Port Huron, Mich.*

Color chart—This guide to the most accepted colors and combinations of colors for home products shows the eight most commonly used colors and those hues that best harmonize with them. The chart is the result of consumer testing and is based on the colors that are being most consistently bought. The colors shown are not predictions made from what consumers say they are going to buy, but are the colors that the consumers are actively buying in new and replacement products. $15. *Modes & Fabrics, Industrial Designers, 150 E. 35th St., New York 16, N. Y.*

Packaging—Business Service Bulletin 122 offers a summary of information on packaging materials han-

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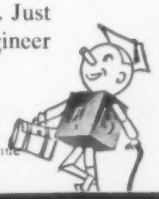

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dling, including package design, handling equipment as related to packaging machinery, preshipment testing, marking, palletization, warehousing, government packing requirement, packaging materials handling cost, and other topics. *U. S. Dept. of Commerce, Business and Defense Services Administration, Washington 25, D. C.*

Industrial fabrics—Swatch folder shows actual samples of various fabrics and tapes for industrial use, including glass, cotton, Vinyon, Dynel, and Orlon. *Flightex Fabrics, Inc., 93 Worth St., New York 13, N. Y.*

Eye protection—"The Spectral-Transmissive Properties of Plastics for Use in Eye Protection," also designated the Z2 report, covers currrently available types of plastics suitable for use in protecting eyes. This includes protectors such as lenses, head and face shields, and goggles. Plastics were studied for their ability to protect the eyes from the absorption of ultra-violet, luminous, and infra-red rays from industrial equipment, and from the sun; test methods are described and results are presented. This report was prepared by the Subcommittee on Transmissive Properties of Plastics and approved by the Committee on Eye Protection of the Sectional Committee on Heads, Eyes, and Respiratory Organs, Z2, which operates under the procedures of the American Standards Association $1.50. *American Standards Association, 70 E. 45th St., New York 17, N. Y.*

Plant design—Engineering and construction services, from preliminary surveys to initial operation of process plants, are outlined in Bulletin 2505. The fields covered by these services include general chemicals, resins and plastics, fats and oils, chlorine and alkalies, petroleum and petrochemicals, wool utilization, fertilizers, low-temperature processes, synthetic fuels, and special nuclear development work. *Chemical Plants Div., Blaw-Knox Co., Pittsburgh, Pa.*

Cutting tools—Catalog describes a selection of hand and machine cutting knives and tools for the plastic, rubber, and other industries. The

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booklet also suggests ideas for many soft- and hard-goods cutting tools *Hyde Manufacturing Co., Southbridge, Mass.*

Vibrators—Catalog No. 11 describes a complete line of electric vibrators, giving specifications and prices. Information on vibrating tables, and pneumatic vibators is also furnished. Mounting and installing instructions are provided. *Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio.*

Parts finishing—Bulletin 834 discusses an airless abrasive blast cleaning method for use in connection with the manufacture of electrical parts. *American Wheelabrator & Equipment Corp., Mishawaka, Indiana.*

Polyethylene insulation—Number 81 of *Kabelitems* (June 1955) describes the use of polyethylene insulation for heavy-construction power systems, specifically in connection with work performed on the Dalles Dam project in the Columbia River basin. Polyethylene was used for insulation of the 480-v. secondary distribution system. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Printing inks—Listing 14 different standard flexographic inks, an ink selector shows which ink should be used to print all commonly used materials for packaging and related use, and gives helpful tips on the proper handling of flexographic inks. Production of inks (research, quality control, etc.) is described in this 16-page booklet. *Bensing Bros. & Deeney, 3301 Hunting Park Ave., Philadelphia 29, Pa.*

Hydraulic presses—Bulletin No. 1036-B gives descriptions and specifications on Elmes Hydrolairs, small hydraulic production presses powered solely by compressed air. Dimensional and operational data, tonnage capacities, and specifications on electric and steam-heated hot plates are included. *Elmes Engineering Div., American Steel Foundries, Cincinnati 29, Ohio.*

Solvent — Applications, physical properties, specifications, shipping data, general solvent properties, constant-boiling mixtures, and phys-

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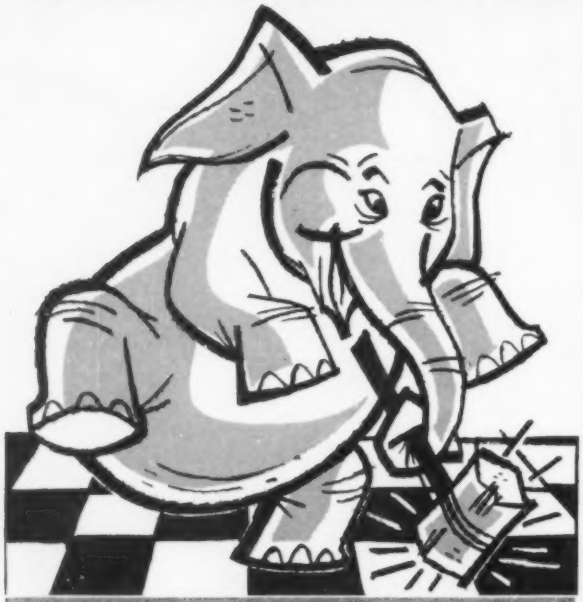

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iological properties of methyl isobutyl ketone are discussed in Bulletin F-8637. Methyl isobutyl ketone's good solvent properties are the basis for its use in the formulation of cellulose nitrate lacquers and thinners. It is also a good solvent for a number of coating resins, including vinyl chloride-acetate copolymers, most acrylic esters, certain alkyds, and polyvinyl acetate. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Fabricated products — Forty-eight page general catalog illustrates and describes a complete line of polyethylene and poylvinyl chloride fabricated products, plates, sheets, rods, tubes, pipes and fittings, and hot gas welding and spraying equipment. One section is devoted to charts showing chemical resistance to more than 150 reagents of products made from polyethylene and polyvinyl chloride. Other sections cover self-supporting structural fabrications, P.V.C. and polyethylene laboratory ware, details on specifying plates, sheets, rods, and the like, and operating and design features of hot gas welding and spraying equipment. *American Agile Corp., P. O. Box 168, Bedford, Ohio.*

Molding alkyds—Proper tools, equipment, and techniques for best results with Plaskon alkyd molding compounds are covered in this 8-page booklet. Putty, granular, and reinforced alkyds are discussed, with specific recommendations. Molding presses and equipment, mold design and construction, preheating, preforming, molding techniques, and the use of inserts are considered. Graphs illustrating minimum cure time vs. temperature for three types of alkyds are presented. *Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Asbestos textiles — Sixteen-page manual covers asbestos lap, roving, yarn, cloth, tubing, cord, wick, rope, and tape. This manual is prepared primarily for designers and purchasing agents in companies which incorporate asbestos textiles in their products. The manual also can be of value to those interested in uses where high ambient and operating temperatures prevail. *Johns-Manville., 22 E. 40th St., New York 16, N. Y.*

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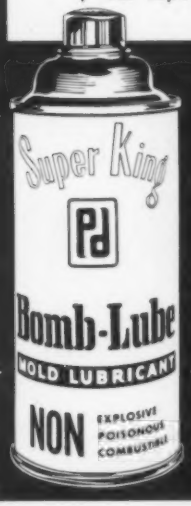

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 4 mos. 1955*	*Total sales first 4 mos. 1955*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester		
Sheet, under 0.003 gage	6,573,772	6,321,021
Sheets, 0.003 gage and over	4,950,706	4,684,014
All other sheets, rods, tubes	2,526,417	2,271,894
Molding, extrusion materials	29,081,740	28,271,106
Nitrocellulose sheets, rods, tubes	1,688,649	1,842,962
Other cellulose plastics	2,439,649	2,156,133
PHENOLIC AND OTHER TAR-ACID RESINS:		
Molding materials[a]	70,715,936	65,225,468
Bonding and adhesive resins for:		
Laminating (except plywood)	22,259,367	15,852,562
Coated and bonded abrasives	4,478,971	4,965,468
Friction materials (brake linings, clutch facings, etc.)	8,247,987	7,404,931
Thermal insulation (fiber glass, rock wool)	12,969,160	13,440,703
Plywood	15,224,968	12,729,240
All other bonding and adhesive uses	4,846,406	4,970,218
Protective-coating resins	8,082,481	8,348,238
Resins for all other uses	13,753,410	12,836,519
UREA AND MELAMINE RESINS:		
Textile-treating and textile-coating resins	14,773,872	14,241,765
Paper-treating and paper-coating resins	7,353,276	7,273,702
Bonding and adhesive resins for:		
Plywood	31,195,052	29,143,169
All other bonding and adhesive uses, including laminating	9,938,863	9,809,921
Protective-coating resins	11,983,106	9,193,123
Resins for all other uses, including molding	26,780,157	25,950,259
STYRENE RESINS:		
Molding materials[a]	132,169,363	127,456,433
Protective-coating resins	32,766,828	32,566,568
Resins for all other uses	27,059,046	26,305,198
VINYL RESINS, total[b]	221,972,813	218,518,854
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for:		
Film (resin content)		29,176,449
Sheeting (resin content)		17,797,903
Molding and extrusion (resin content)		62,858,723
Textile and paper treating and coating (resin content)[c]		20,522,174
Flooring (resin content)		19,494,826
Protective coatings (resin content)		9,989,355
All other uses (resin content)		15,008,811
All other vinyl resins for:		
Adhesives (resin content)		10,372,878
All other uses (resin content)		33,297,735
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS	82,789,957	83,726,500
POLYESTER RESINS:		
For reinforced plastics	16,293,893	12,997,632
For all other uses	1,280,140	1,582,163
MISCELLANEOUS:		
Molding materials[a, d]	101,695,345	74,791,135
Protective-coating resins[e]	1,528,915	927,256
Resins for all other uses[f]	41,657,560	61,107,125

* Dry basis designated unless otherwise specified.
** Partially estimated. † Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR MARCH AND APRIL 1955 by U. S. Tariff Commission

*March***		*April***	
Production	*Sales*	*Production*	*Sales*
2,096,467	1,911,420	1,398,906	1,452,743
1,418,895	1,428,079	1,243,176	1,108,227
765,440	690,386	623,169	567,009
7,422,246	7,046,427	7,574,476	7,406,053
483,053	523,238	427,180	433,764
743,534	597,003	584,278	478,399
19,287,162	17,717,015	18,876,464	16,372,342
5,841,494	3,979,687	5,159,155	3,820,505
1,226,943	1,330,063	1,204,860	1,262,860
2,418,310	1,913,971	2,188,320	1,958,151
3,545,871	3,719,919	3,624,480	3,667,114
3,810,570	3,099,351	3,672,430	2,975,713
1,274,345	1,295,715	1,352,704	1,320,364
2,597,956	2,197,794	2,568,338	2,291,343
4,054,342	3,511,882	3,370,039	3,270,370
4,189,000	3,875,122	3,496,609	3,443,276
2,088,310	1,928,700	1,958,882	2,038,283
8,856,800	8,337,475	7,741,433	7,583,765
2,506,593	2,823,592	3,058,263	2,579,109
3,176,397	2,454,317	3,086,175	2,317,829
7,315,525	7,431,107	7,455,711	6,767,495
37,130,688	35,745,732	34,996,616	33,857,545
†8,324,930	†8,381,410	8,304,109	8,469,020
†7,054,044	†6,963,112	6,827,738	7,424,837
59,767,437	58,068,156	56,773,223	56,848,499
	8,052,321		8,227,049
	4,429,234		4,709,243
	16,101,543		15,568,118
	5,401,896		5,779,100
	5,208,125		5,134,130
	2,815,044		2,601,266
	4,336,326		3,271,231
	2,858,828		2,585,550
	8,864,839		8,966,812
†22,773,691	†23,259,908	22,533,226	23,011,097
5,032,624	3,890,845	4,743,027	4,015,387
166,981	262,232	168,590	195,358
25,674,557	19,294,858	28,435,753	19,642,107
338,668	218,546	408,057	248,117
11,384,360	17,947,225	12,473,380	18,514,656

data for spreader and calendering-type resins. ‡ Includes data for acrylic, polyethylene, nylon, and other molding materials. * Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins. † Includes data for acrylic rosin modifications, nylon, silicone, polyethylene, and other plastics and resins for miscellaneous uses.

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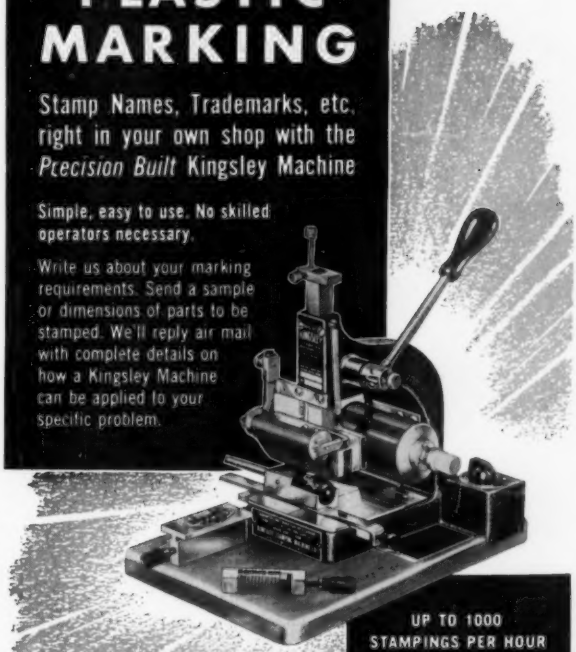

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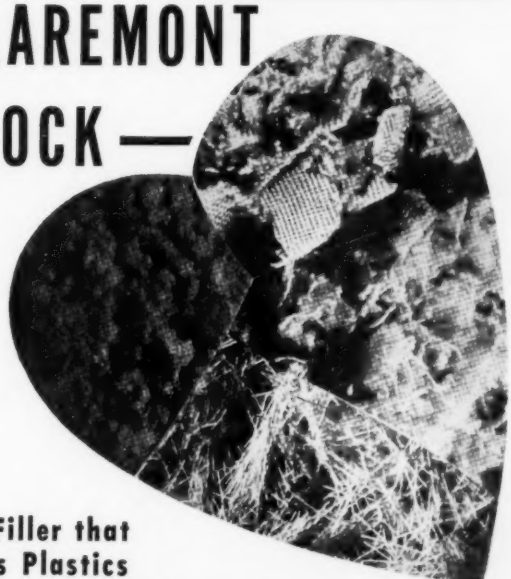

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The cabinet, the one-piece louver panel, and the bottle opener on the front of the cabinet, are molded of styrene in a three-cavity mold. The base of the cabinet and the various knobs and decorative features are molded separately and assembled by cementing or screwing. Dial calibrations and all lettering are hot-stamped on the face of the plastics parts.

To overcome the tube heat problem, the base of the cabinet is molded with a series of air holes and an exhaust opening is molded into the top rear of the cabinet. These openings, coupled with the louvers in the front of the cabinet, provide necessary cross ventilation while the radio is in operation.

In addition to the design potentials of molded styrene which made possible realistic duplication of the soda cooler, the plastic was chosen for the application because of its strength, its smooth surface finish, and its easy cleanability.

CREDITS: Molded by P. M. Industries, Inc., Stamford, Conn., using styrene supplied by The Dow Chemical Co. Cabinet designed by Curtis Pearl, Ankurt Assoc. Engineers, New York, N. Y.

Radio cabinet molded of styrene is a miniature model of soda cooler

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POLYESTER RESINS. Technical booklet gives details about "Paraplex 'P' Series" resins. Properties, formulations, curing data, fields of application and fabricating suggestions are included. Resinous Products Division, Rohm & Haas Co. (H-504)

VINYL CHLORIDE. Booklet contains wealth of ideas and suggestions for designers and product engineers involving the use of molded and extruded vinyl chloride parts and products. Monsanto Chemical Co. (H-505)

MOLDS FOR LAMINATED PLASTICS. Profusely illustrated booklet describes facilities and background of custom service organization specializing in the production of complete metal molds for laminated plastic molding. Engelking Patterns, Inc. (H-506)

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STEEL FOR MOLDS. Brochure gives properties, analysis, and "how to use" data on "Speed Alloy," an easy-to-machine steel with characteristics that bridge the gap between carbon and tool steels. W. J. Holliday & Co. (H-509)

EXTRUDING SERVICE. Brochure employs photographs and text to describe company's facilities for custom extruding, die-making, engineering and fabricating. Crescent Plastics, Inc. (H-510)

POLYAMIDES. Data folder presents detailed tabular information on six types of polyamide moulding powders: their basic characteristics and uses, and their physical, chemical, thermal, and electrical properties. Holzverzuckerungs AB (Switzerland). (H-511)

ACETATE SHEET AND FILM. Brochure offers comprehensive data on the properties, uses, and methods of fabrication of company's extensive line of cellulose acetate sheets and film. Sample swatches included. Utilex Ltd. (H-512)

FORM GRINDING SERVICE. Leaflet describes company's custom form grinding of cylindrical parts from synthetic and nonmetallic substances. Orange Products, Inc. (H-513)

REPAIRING REINFORCED PLASTICS. Illustrated manual gives step-by-step instructions for the repair of damaged glass fiber reinforced polyester surfaces. Naugatuck Chemical, Div. of U. S. Rubber Co. (H-514)

UNIVERSAL TESTING MACHINE. Brochure describes a testing machine capable of testing specimens or parts in tension, compression, flexure, torsion, alternating load, creep, stress relaxation and shock, up to a rated capacity of 25 tons. Baldwin-Lima-Hamilton Corp. (H-515)

COATINGS FOR PLASTICS. Folder contains descriptions and chip samples of a line of color coatings for plastics, available in three basic groups: one for fabricated styrenes and acrylics; another for molded polystyrene; and the third, "Metalplex" for metallizing of plastics. Chemicals Div., Sullivan Varnish Co. (H-516)

OVENS, DRYERS, CONDITIONERS. Illustrated catalog presents extensive line of heating, drying, and conditioning machines for industrial processing equipment. Included are electric conveyor ovens, heating cabinets, annealing units, gas-fired ovens. Lydon Brothers, Inc. (H-517)

TRANSPARENT AND REINFORCED PLASTICS PARTS. Illustrated brochure describes case histories, shows engineering and production facilities of this company, which specializes in custom fabrication of transparent plastics sheet and in reinforced laminates. Swedlow Plastics Co. (H-518)

STEEL STAMPS AND DIES. Illustrated folder describes a line of custom steel stamps and dies for hot stamping, decorating, and embossing; also master hobs for molds. Sossner Steel Stamps. (H-519)

PLASTIC PREHEATER. Illustrated sheet lists details, specifications, and advantages of model "15-B" plastic preheater. Machine is designed to handle medium sized loads of compounds in compression or transfer molding. W. T. LaRose & Assoc. Inc. (H-520)

MOLD RELEASE SPRAY. Folder describes a silicone spray and a dry powder spray for use as mold release agents. Features are described and instructions for using sprays are presented. Prices given. Injection Molders Supply Co. (H-521)

INORGANIC ELEMENTS. Twenty-seven page manual of applications for "Ferro" inorganic colorants. Includes a table of pigment properties. Ferro Corporation. (H-522)

MILL AND MIXER. Folder describes performance of centrifugal impact mill for use in mixing, grinding, and scrap reduction of dry materials. Entoleter Division, The Safety Car Heating and Lighting Company, Inc. (H-523)

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EQUIPMENT FOR DECORATING PLASTICS. Catalog describes line of equipment for decorating plastics by spraying and wiping. Describes company's facilities for producing custom spray masks. Prices are given. Finish Engineering Co., Inc. (H-525)

PLASTICS MATERIALS. Booklet contains brief outline of physical characteristics and applications of Celanese plastics, including molding, laminating, film and sheeting materials. Celanese Corporation of America. (H-526)

GRANULATOR. Folder presents specifications and description of granulator with hourly capacity of 200 lbs. Maintenance and cleaning instructions also included. De Mattia Machine & Tool Co. (H-527)

INJECTION MOLDING MACHINE. Brochure gives specifications and description of 4 ounce automatic injection molding machine. Interesting feature of literature is sequence of photos showing machines' automatic de-gating and ejecting feature. F. J. Stokes Machine Co. (H-528)

ADHESIVE FOR POLYESTER FILM. Leaflet covers a full range of adhesives for use with "Mylar" polyester film. Applications such as "Mylar" to paper, to aluminum foil, to steel, to vinyl, and to polyethylene are described. Flexibility, complete clarity, and resistance to heat are their outstanding characteristics. Rubber and Asbestos Corp. (H-529)

HEAT SEALING PRESS. A 4-post press with bed plates from 16" x 24" up to 48" x 96", adaptable to high production heat sealing operations, is discussed in this folder. Mayflower Electronic Devices Inc. (H-530)

ELECTRIC HEATING UNITS. Eight page brochure discusses cartridge, strip, band, ring, tubular, and immersion heating units used for heating platens, presses, extruders, molds, etc. Vulcan Electric Co. (H-531)

ABRASIVES. Leaflet on two types of oil stone abrasives, for die, mold, and pattern makers. Stones range in size from 1" to 2", and are assorted to eliminate need for preparing large stones. Random Abrasive Co. (H-532)

COLORANTS. Data sheet lists 19 colors and furnishes price per hundred pound unit of paste or dry colors used in injection molding and extrusion, or for polyester-fiber glass fabrication. Plastics Color Co. (H-533)

PAINT SPRAYING EQUIPMENT. Catalog covers a wide variety of items, including spray guns, feed cups, hose, spray booths, and other accessories used in spray painting. The DeVilbiss Co. (H-534)

HEAT EXCHANGER. Bulletin describes operation of heat exchanger used for controlled temperature cooling of water, oil, and other liquids and gases employed in hydraulic presses, molds, and extruders. Niagara Blower Co. (H-535)

RIGID SHEET POWER CUTTER. Details on compact power cutter for preforming a variety of machining operations on rigid plastic sheet, such as beading, folding, nibbling, slotting, etc. Nord International Corp. (H-536)

AUTOMATIC VACUUM FORMING. Leaflet covers new "A.P.M." vacuum drape forming machine which utilizes two working tables to facilitate greater productivity. Four models give working tables ranging from 30" x 30" to 60" x 90", and draws up to 14". Abbott Plastic Machine Corp. (H-537)

REINFORCED PLASTICS. Brochure on special design-through-production service available to users of glass reinforced plastics. Describes typical applications for plastics tooling which includes metal forming dies, jigs, plastics forming dies, laminating molds, etc. East Coast Aeronautics, Inc. (H-538)

POLYMETHOXY ACETALS. Technical report covers properties and toxicity data on polymethoxy acetals which may be used as modifiers for phenolics, urea, melamine, and polyvinyl alcohol; as a plasticizer; or in the shell molding process. General Aniline & Film Corp. (H-539)

ELECTRIC HEAT TRANSFER SYSTEM. Brochure deals with electric heat transfer unit having circulating thermal liquids to provide controlled, uniform temperatures in extruders, dies, presses, platens, calender rolls, etc. Specifications and chart cover fourteen different models. Gerin Manufacturing Co. Inc. (H-540)

GLASS-FIBER REINFORCED PARTS. Literature covers physical properties, heat and electrical resistance, water absorption, chemical resistance, and other characteristics of custom molded parts made of glass-fiber reinforced polyester. Grand Haven Plastics Co. (H-541)

"TRU-CAST" HANDBOOK. Handy guide on the use of beryllium copper pressure-cast cavities and cores. Covers applications of beryllium copper components in injection and compression molding, stamping dies, and other applications. Manco Products, Inc. (H-542)

USES FOR "TEFLON." Bulletin describes unique properties of "Teflon" resin which is applicable as insulator tapes, gaskets, coating, V-packings, or for molded or machined parts. Material is available in sheet, tape, "O" rings, rod, tubes, and custom forms. Micromold Products, Inc. (H-543)

HEAVY DUTY CRUSHERS. Details on equipment for reducing, by crushing, granular or bulk plastics. Machines are described as being able to handle up to 4 tons per hour and up to 7 inch chunks. Franklin P. Miller & Son Inc. (H-544)

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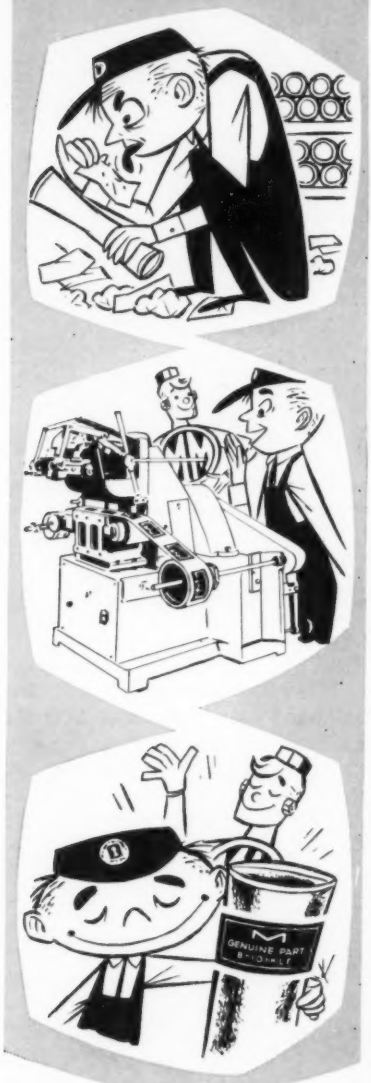

Typical of the parts identification marking problems Markem solves is this one involving metal tail pipes. In place of costly, wrap-around paper labels that wouldn't stick, the manufacturer now prints complete label detail on pressure-sensitive tape, using a Markem 26A machine. Imprints are neat and clear—tape stays on. If identifying, decorating or designating a product, part or package is your problem, let Markem help you. Since 1911, Markem machines, type and ink have helped industry make its mark—better. They can do the same for you. Just write Markem Machine Company, Keene 20, New Hampshire.

MARKEM
...TO MAKE YOUR MARK

Clip-on mechanism of sunglasses (top) has two-pronged molded nylon part

Clip-on Glasses

LIGHT weight and ease of attachment are two of the advantages of newly designed all-plastic sunglasses that clip on the bridge of the user's regular eyeglasses. Unlike the usual type of clip-on models that have four grips, two each at the top and bottom of the frame, the Opti-Clip sunglasses have a hinged and spring-loaded clip with two prongs that hold the sunglasses in place by pressing against the lenses of the eyeglasses. The clip is molded of nylon and the sunglasses are molded of acrylic, with bridge and lenses molded in one piece. Hinge pins on the nylon clip are held under tension in two molded-in notches in the acrylic bridge.

The nylon clip, which combines durability with the resiliency required for the job, is produced in an eight-cavity mold on a 3-oz. injection molding machine. After molding, the tips of the nylon prongs are dipped into a rubber latex to provide a soft cushion between the lens of the eyeglasses and the prongs.

In production assembly of the nylon clip to the sunglasses, the prongs are simply pressed against the back of the sunglass lens and forced in and down until the hinge pins snap into position.

The clip-on's can be attached to or removed from the regular glasses with just one hand.

CREDITS: Fosta Opti-Clip sunglasses and clip are molded by Foster Grant Co., Leominster, Mass. on 3-oz. Fellows Leominster machines. Zytel No. 101 nylon supplied by E. I. du Pont de Nemours & Co., Inc.; Plexiglas VM 687 supplied by Rohm & Haas Co.

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CENTERLESS GRINDER

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You get more precision ground beads or balls because

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Royal Master Centerless Grinders are compact. Model P.G. 7, occupies only 24" x 36" of floor space.

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250 State Highway 23, Riverdale, N. J.

Pedal boat pontoons are molded of corrosion-resistant reinforced plastics pigmented red, blue, or yellow. Each pontoon is divided into four water-tight compartments

Plastics Pontoons for Pedal Boats

MOLDED reinforced plastics pontoons that are virtually unsinkable contribute to the success of a new type of pedal boat developed for amusement parks by Dallas Engineers, Inc., Dallas, Pa., and known as the Water-Skeeter.

Each pedal boat has two pontoons, 12 in. in dia. and 10 ft. long. As an added safety factor, the pontoons are each divided into four compartments by water-tight bulkheads. The rugged rounded nose of the pontoons allows the Water-Skeeter to glide rapidly through the water, and also affords excellent protection when the boats are being beached.

Unlike the metal pontoons previously used, the molded reinforced plastics pontoons, which are pigmented red, blue, or yellow, require no maintenance or painting or other surface coating. They will not rust or corrode, even when used in sea water or acid river water. They also will take considerable abuse without denting and, if damaged in any way, can be quickly and easily repaired.

The pontoons are molded in two halves and bonded together along a 1-in. molded-in flange. A single preform, made on a large preform machine, is used. The thickness of the molded part is 0.080 in. and the weight of the preform is between 4½ and 5 oz. per sq. foot. The dies used in molding the pontoons are made of Meehanite castings, machined and flame-hardened, and are mounted in a 400-ton hydraulic press. The cure cycle is approximately 3½ minutes.

After the parts are molded, the flanges are sanded smooth for proper bonding. The surfaces where the 12-in.-dia. reinforced plastics bulkheads are put in are also sanded smooth. Each polyester-fibrous glass bulkhead is molded with a 1-in. flange that facilitates bonding to the inside of the pontoon. If a pontoon springs a leak in one bulkheaded compartment, the other compartments will support the boat until it can be beached.

Bonding is done in a steam-heated jig using mechanical clamps for pressure. After bonding, the pontoons are tested for water-tightness by being immersed in a 6 ft. deep tank for 30 minutes.

CREDITS: Pontoons are molded by Molded Fiber Glass Body Co., Ashtabula, Ohio; silane-treated No. 851 fibrous glass rovings supplied by Owens-Corning Fiberglas Corp.

HEAT FOR PLASTIC PROCESSING

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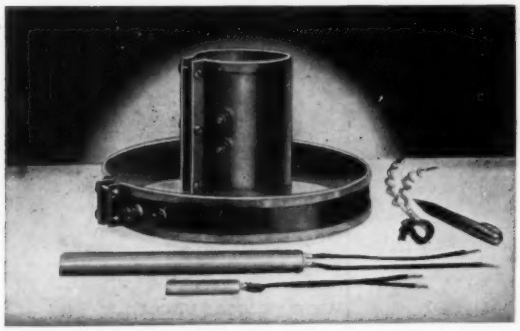

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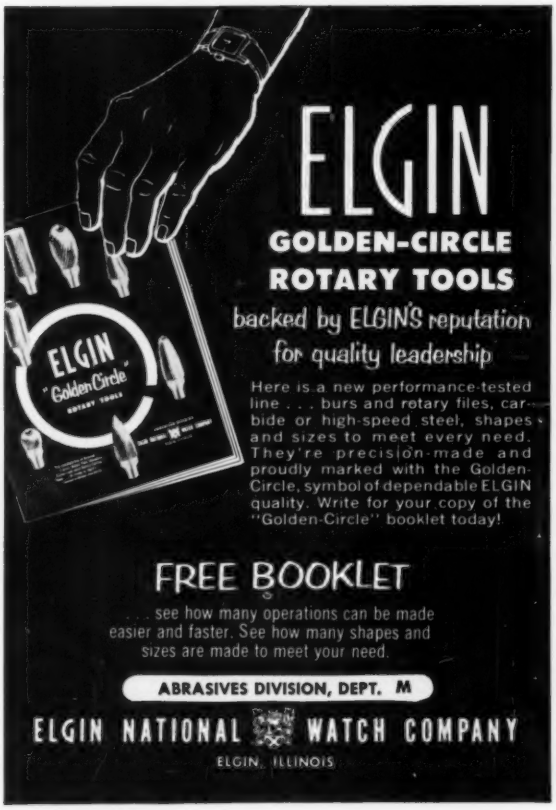

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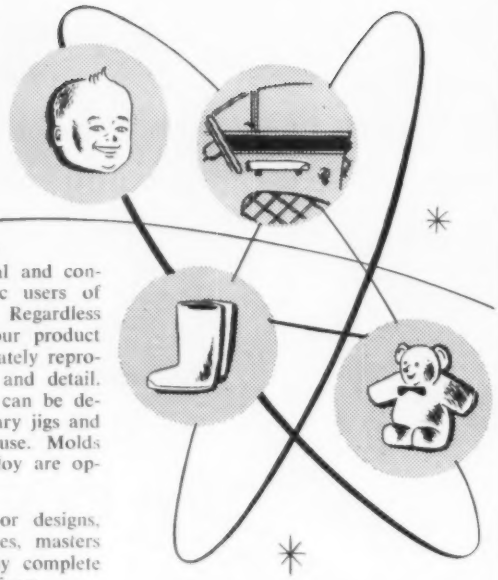

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Manufacturers of both industrial and consumer products are enthusiastic users of molds made by Plastiplate Co. Regardless of how small or how large your product may be, Plastiplate molds accurately reproduce the most intricate design and detail. What's more, Plastiplate molds can be delivered complete with all necessary jigs and fixtures, ready for immediate use. Molds plated with a special release alloy are optional.

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Plastiplate also specializes in electroplating small plastic pieces such as buttons, beads and novelties—any color—any finish. Ask for details.

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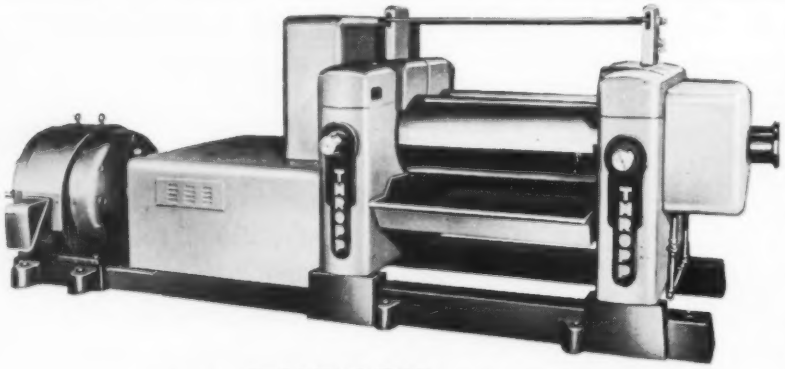

The THROPP 60" MILL
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Other production mills are available in 42", 50", 72" and 84" sizes for the Rubber and Plastics Industries. Altogether, these mills represent a combination of good engineering and plain common sense.

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Tobacco growers used vinyl for

Soil Fumigation

BETTER-QUALITY tobacco leaves are claimed to be the result of a pre-growth soil fumigation process made possible by the use of sheets of flexible vinyl extending 100 sq. ft. in area.

After selecting the site where the tobacco is to be grown, the sheeting is placed over the open ground prior to planting the seeds. A tight seal between cover and ground is obtained by shoveling earth over the outer edges of the flexible vinyl sheet, making sure to cover the entire periphery.

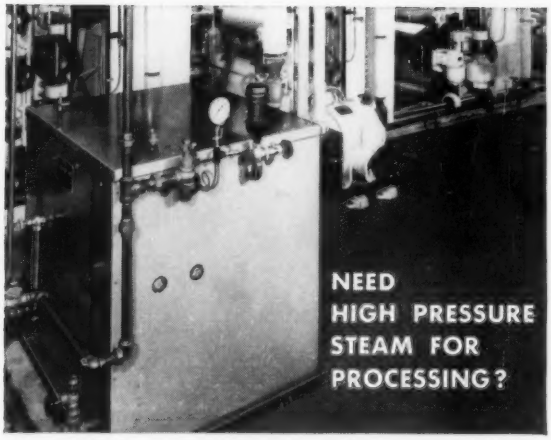
Methyl-bromide fumigant gas is then pumped under the vinyl sheeting. Within 24 to 48 hr., the gas will have rid the seed bed of weeds, insects, soil organisms, or other elements that might be harmful to the growth of the tobacco. After the removal of the cover, the fumigated soil can be seeded in the conventional manner to produce large, superior tobacco leaves.

The tough vinyl covers, can be reused many times. They are weatherproof, impervious to sunshine or moisture, and are characterized by a high resistance to the action of acids, alkalies, oils, greases, and chemicals.

The vinyl sheeting has proved especially applicable for the soil fumigating process because of its elasticity and its ability to retain the fumigating gas for long periods of time.

CREDITS: Seed bed covers are sold by Electro Plastics Fabrics, Inc., Pulaski, Va.; Geon vinyl sheeting is supplied by B. F. Goodrich Chemical Co.

Fumigating gas is pumped under vinyl cover laid over tobacco seed bed



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IT ISN'T SIZE— IT'S Quality THAT COUNTS

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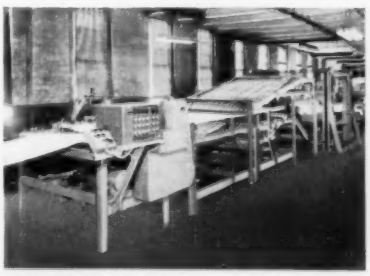
Hobbs "Jacques" Hand Shears are made in lengths from 24" to 10' and cut cleanly, in one easy stroke, not only plastics, but any soft material. The Jacques Bench Shear is easily mounted for straight or angle cutting and is readily moved from one location to another. Jacques Hand Shears with gauges are also available.

The Automatic Electronic Cutter, shown here, has doubled production and reduced labor cost by 2/3. It handles material 60" wide.

Send for a "Hobbs Engineered Cutting Survey Questionnaire". With the information it requests we'll make recommendations, free of all obligations.



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PLASTIC GRANULATOR

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This American installation, with specially designed hopper for receiving long lengths of plastic hose, has been averaging over ¼ ton of plastic scrap a day since installation. The scrap includes styrene, vinyl, plexiglas, butyrate and ephocel.

On over a year of operation not one cent has been spent on replacement parts—and no maintenance other than greasing and knife sharpening.

The KC's high capacity cuts labor costs, takes an operator less time to feed scrap than smaller, less efficient granulators.

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Teflon-insulated hook-up wire is color striped for easy identification

Striped Wire

EXTRUDED Teflon-insulated hook-up and lead wire previously made only in solid colors is now being manufactured for the first time with two or three color-coded stripes on the insulation. Colors are applied with special printing equipment or are in the form of a spirally wound tape and are claimed to retain their brightness and clarity even under prolonged exposure to light, extremes of heat, or in contact with solvents.

The insulated wire, which is produced in sizes from 10 to 26 AWG, is available in two ratings—Type TX for 600 v. r.m.s. and Type HX for 100 v. r.m.s. Conductors consist of silver plated, stranded, or solid copper.

The Teflon insulation will withstand continuous operating temperatures from —90 up to 260° C. without deteriorating. The insulation is non-flammable, has zero water absorption, and remains unaffected by all known commercial solvents. Types TX and HX conform to MIL-W-1687A (Navy) for Type E and Type EE respectively.

Special strandings and wall thicknesses, including multi-conductor and coaxial cable, are available on request. Special constructions include shielding or Teflon-impregnated fibrous glass braids.

CREDITS: Temprex wire produced by Hitemp Wires, Inc., Mineola, L. I., N. Y.; Teflon polytetrafluoroethylene supplied by E. I. du Pont de Nemours & Co., Inc.

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—WITH THE SENSATIONAL NEW

DE MATTIA
SERIES M
MOLDING MACHINES

- IMPROVED DESIGN
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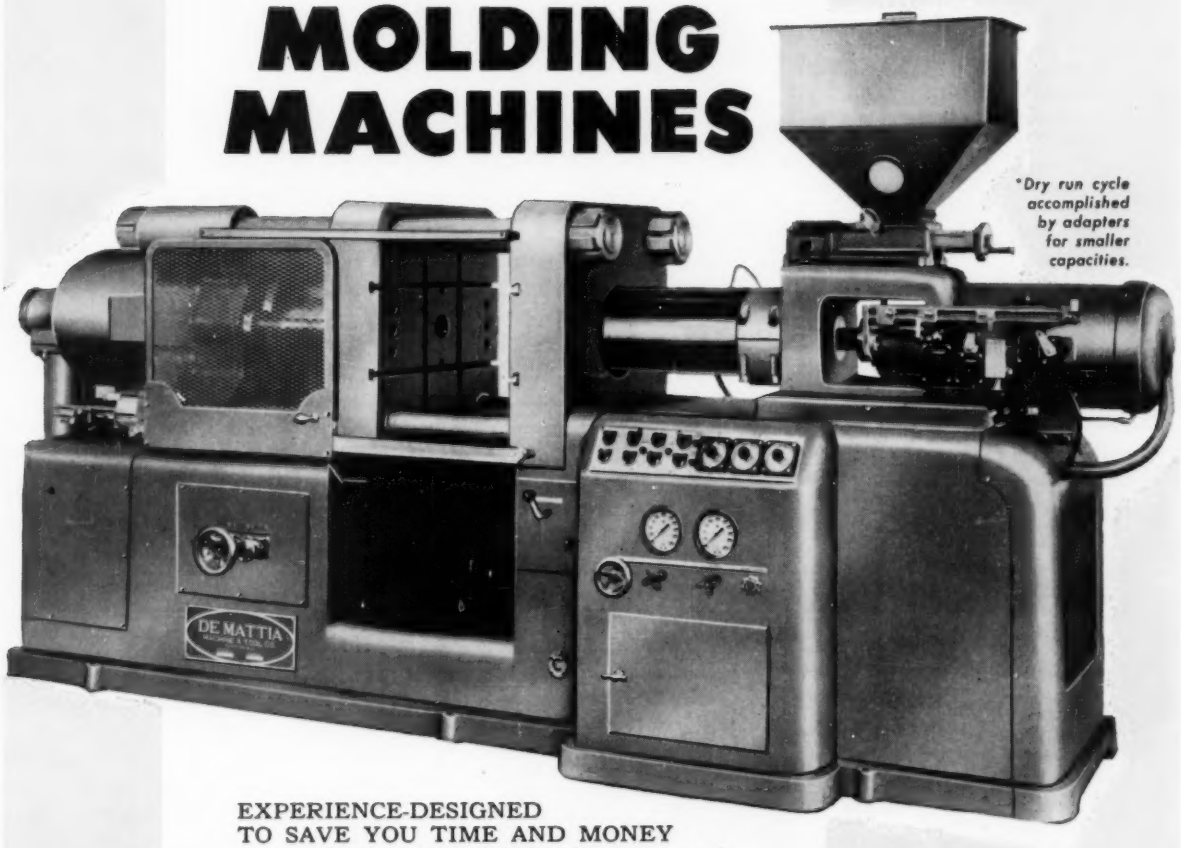
- UP TO 6 CYCLES PER MINUTE*
- 16 OUNCES BY AUTOMATIC PRE-PACKING

*Dry run cycle accomplished by adapters for smaller capacities.



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the new Model M Molding Machines are another step forward in molding production. These high efficiency injection machines help you meet competition... are expressly designed to increase your molding production and cut your molding costs. Series M machines offer fully hydraulic operation, up to 6 cycles per minute on smaller shots and shots up to 16 ounces by means of automatic pre-packing!

Available in 8 and 12 oz. Models. The De Mattia Line also includes 4 oz. Verticals, 4 oz. Horizontals and Various Models of Scrap Grinders. Write for Illustrated Bulletins.

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Thermaflow materials flow easily and cure fast. They're ideal for molding large parts with deep draws. They retain intricate mold details, too.*

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Izod impact strength . . . 12 to 24 lbs. per in. notch

Heat distortion point . . . 300°F (compounds available to 500°F)

Dielectric strength . . . 340 v.p.m.

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Resistance to hot acids and alkalies . . . complete

Thermaflow can do a better job than stainless steel in withstanding most chemicals and do it at a greatly reduced cost.

Write today and tell us your needs. We'll be glad to supply detailed information.

*NOTE: Thermaflow moldings can often replace expensive die castings, provide improved properties, and cut costly machining operations.

THERMAFLOW chemical corporation
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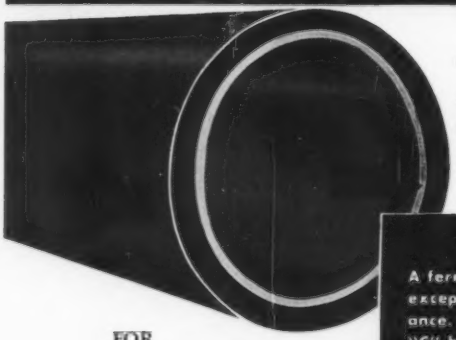
MEETING the PROBLEMS of the RUBBER - PLASTICS INDUSTRIES



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Wings and tail of toy "mechanical bird" are covered with polyester film

Mechanical Bird

AVAILABILITY of thin, tough, flexible Mylar polyester film shares credit in the development of what is stated to be the first toy "mechanical bird" to be propelled through the air by the flapping of wings.

The device, which is known as "Winge-e" and looks like a small model plane without a propeller, is powered by several rubber bands running through the injection molded styrene fuselage and connected at one end to a simple drive unit under the wings. A small crank in the nose of the toy is used to put tension on the bands. When the rubber-band motor unwinds, the wings flap up and down and the model swoops, soars, and dives.

Molded-in slots in the fuselage hold the crank shaft and the wires which form the wing framework.

To minimize as much as possible any damage to the toy by rough handling or because of the strain put on the wings by the flapping motion, the tapered wings (with a 15-in. spread), as well as the tail of the device, are covered with tear-proof polyester film that has been printed and die cut to shape. According to the manufacturers of the toy, polyester film was the only material with the necessary durability, flexibility, and light weight to meet requirements.

CREDITS: "Winge-e" is manufactured by Orthopter Co., Denver, Colo.; Mylar supplied by E. I. du Pont de Nemours & Co., Inc.; film is printed and die cut by Arvey Corp., Chicago, Ill.; fuselage molded by Chaney Plastic Molding Co., Denver, Colo.

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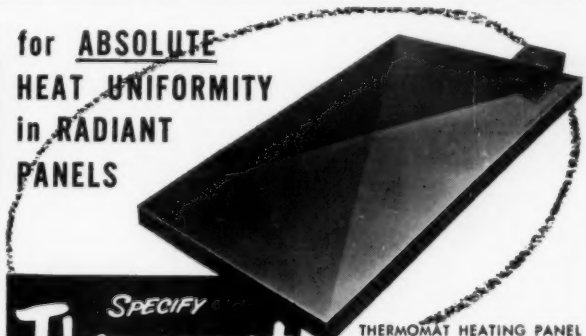

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File boxes for storing color transparencies are molded of styrene

Photo Files

TO FACILITATE systematic filing and to provide protection for color transparencies, all 35-mm. and 828 color film being processed by the authorized dealers of Pavelle Color, Inc., New York, N. Y., will now be returned to photographers, at no additional charge, in rugged file boxes molded of high-impact polystyrene material.

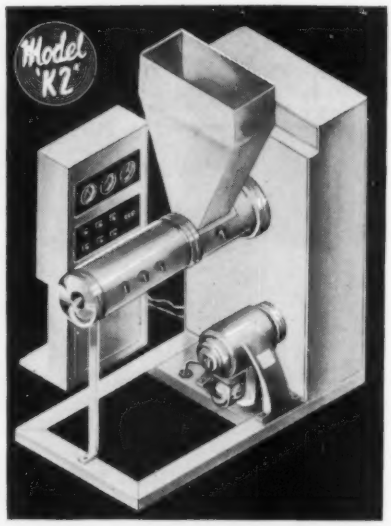
Slide boxes previously used were made of cardboard and were intended only to serve as delivery packages. However, most amateur photographers would use these boxes as files and, through breakage of the cardboard, valuable, and sometimes irreplaceable transparencies would often be damaged.

The rugged styrene file boxes, which can withstand considerable abuse without breaking, adequately solve the problem.

To encourage the photographer to set up an efficient slide storage system, a special tray, which is available through Pavelle's authorized dealers, was designed to accommodate 12 file boxes.

One end of the removable lid for each file box is marked off with molded-in raised borders, providing space for a paste-on label indicating the contents of the box. Pavelle's tradename and trademark, also raised, are molded into the box lid beside the space for the label and are hot-stamped in gold.

CREDIT: Boxes are molded by The Jamison Plastic Corp., North Bellmore, L. I., N. Y., using high-impact polystyrene material supplied by The Dow Chemical Co.



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Model K-2
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Killion Plastic Extruders are designed to meet your particular production needs. Illustrated is an efficient production 2½ inch machine ideal for a continuous delivery of extruded forms. All K models are specially designed to meet your requirements and at a cost that will not strain your budget. They are electrically heated and water-cooled with a separate mobile control stand. The K model will process and deliver a regulated amount of plasticized material suitable for coating or sheeting.

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The screws shown opposite are typical of Killion know-how in precision manufacturing. The largest is 144 inches long with a diameter of 8 inches with special torpedo nose, all accurately made of two pieces. The smallest is a 2-inch diameter screw, 30 inches long and is an exact duplicate of a customer design.

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Formed sheet makes new

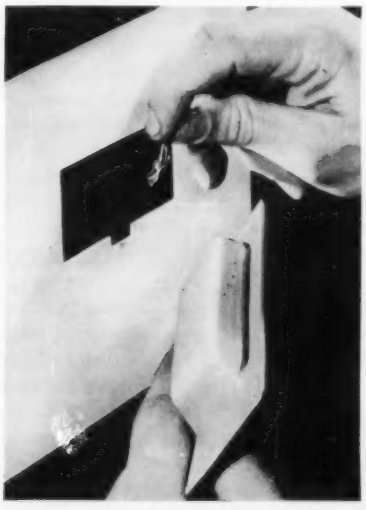
Drawer Pull

DRAWER pulls, vacuum formed in one piece of high-impact styrene sheet, are designed for rapid and simple installation.

To attach the pull to the front of conventional furniture drawers, an inexpensive metal pressure clip is first inserted into a key slot machined into the bottom edge of a rectangular cutout in the drawer front. When the formed pull is pressed by hand into the cutout from the rear, it wedges against the pressure clip and a series of sharp teeth in the clip engage the outside edges of the pull to lock it permanently in place.

Once installed, the smooth, glossy surface finish of the pull adds to the appearance of the furniture and can easily be wiped clean with a damp cloth when it becomes smudged by dirty fingers. The pull is formed with a slight undercut around the periphery which makes it easier to grip — and the high-impact styrene sheet is tough enough to withstand constant use without denting or cracking. Even under extremes of weather conditions — either hot or cold — the pull will not warp or bend out of shape.

CREDITS: Drawer pulls are designed and experimentally produced by Fritz Mulhauser, Chicago, Ill., Campco S-540 high-impact, high-gloss styrene sheet is supplied by Campco Div., Chicago Molded Products Corp., Chicago, Ill.



Metal clip permanently locks formed styrene pull to front of furniture drawer

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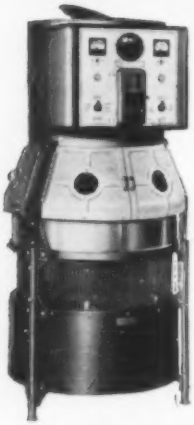

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Now used throughout industry for the development and quality control in manufacturing of products subject to deterioration by sunlight, moisture, and temperature fluctuation. Standard testing programs have been adopted in many industries forpositive assurance of the products' resistance to sunlight and weathering.

Here are a few industries using Fade-Ometers and Weather-Ometers for quality control of their products:

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Plastics and Coated Fabrics
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Automotive Industry
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U. S. Government
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Paint, Varnish, Dry Colors
Paper Mills
and many others

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Translucent corrugated vinyl glazing panels are installed in chemical plant

Vinyl Glazing

INCREASED light transmission and a reduction in maintenance costs are the results obtained by installing translucent rigid vinyl windows in a section of the Port Neches, Texas, plant of Goodrich-Gulf Chemicals, Inc. The vinyl sheeting replaces standard wood sash and glass windows which, because of the harmful influences of weathering and corrosion, had presented a variety of difficult maintenance problems during the past 11 years for the plant's engineers.

Installed in the monitor roof of the machine shop building, the rigid sheeting resists the effects of heat, cold, rain, chemicals, oils, greases, acids, and alkalies. Because of the wide variations in weather conditions in the Southwest and because of the corrosive atmosphere present at almost all times in the Goodrich-Gulf Chemicals plant, the rigid vinyl sheeting has proved an especially ideal glazing material for this particular application.

The corrugated translucent sheets, in tinted green, measure 4 by 6 feet. To install the windows, all wooden sashes and glass panes were first torn out of the top part of the building. The vinyl panels were then securely nailed to the outside walls of the building. Fans will be placed every 24 ft. along the window area to remove the hot air and fumes rising into the monitor roof from the machine shop below.

CREDITS: Glazing panels fabricated by Seiberling Rubber Co., Newcomerstown, Ohio, using Geon vinyl supplied by B. F. Goodrich Chemical Co.

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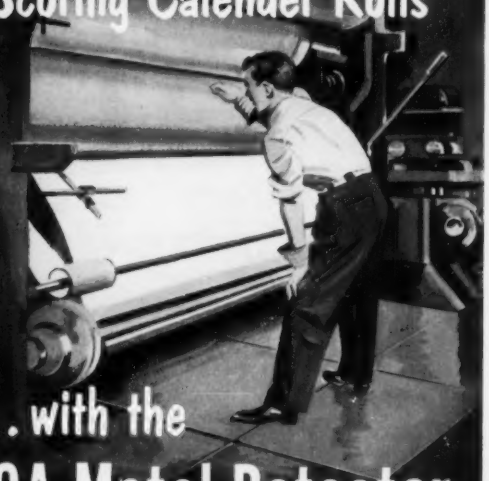

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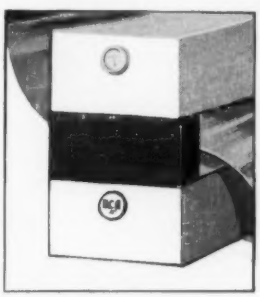

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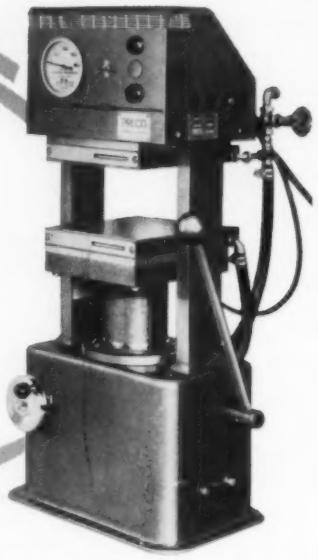

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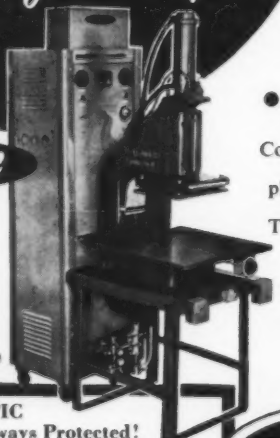

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Nylon News

(*From pp.* 85-96)

and nuts, grommets, and washers. Both screw-machine-fabricated units made from rod and multi-cavity molded parts appear in this picture. The whole development is based on standard dimensions and standard methods of assembly where these products are used.

An important line of nylon-lined bearings is produced by Thompson Industries, Inc., Manhasset, L. I., called Nylined bearings. The line is being so extensively used in business machines where silence, speed at light loads, and non-lubrication are requirements, in shop tools where oiled bearings attract sawdust and dust, in the automotive field where anti-friction is important, in textile machinery, movie projectors, aircraft, and a host of others, that a complete new technology of application and design has grown up around it.

Basically the Nylined bearing is a free-floating nylon liner encased in a thin-wall sleeve of steel. It can be replaced instantly in the field without special tools. Its resiliency resists pound-out, it has abrasion resistance, heat resistance, generally does not need lubrication but can be lubricated in special cases, and usually has a life cost less than bronze bearings or other metallic types.

Another standard nylon bearing line is produced by Nylacore Corp., Great Neck, L. I. This is a sleeve-type bearing composed of a specially designed metal shell into which has been molded an extremely thin inner-lining of nylon rigidly anchored to the outer shell. The thin facing of nylon acts as a bearing surface with very low frictional drag. Distortion due to impact is minimized, and heat generated is quickly dissipated to the metal shell. The main Nylacore line is sleeve bearings, but they may be made with nylon thrust facings, oil seal and dust ring on one end, or one end closed.

Fastening Devices

Next in line of importance as proprietary industrial components are nylon fastening devices. Probably the broadest range of these is produced by the Shakeproof Div., Illinois Tool Works, Elgin, Ill. The

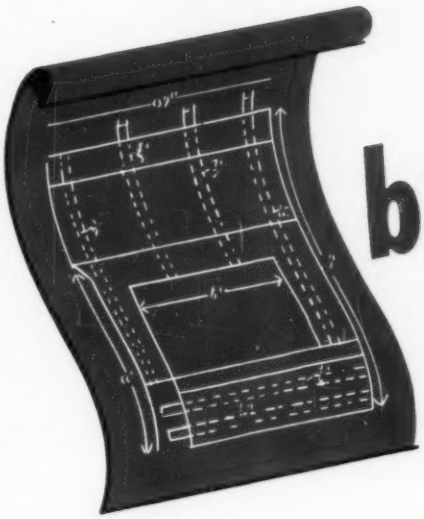
company manufactures Plasti-Rivets, Plasti-Grommets, Plastinite strain-relief grommets, and other specialized items. These parts all employ the strength of nylon in thin sections in order to provide snap-in design. The rivets are used, for example, in refrigerator assembly where a metal rivet would damage enamel. They are used in delicate electronic assemblies, in radios, and for fastening components of reinforced plastics. Again, standards and engineering are involved and the company has worked out a series of sizes and colors for each item most practical for broad range manufacturing industries. The Plasti-Rivet itself is a unique and famous piece of engineering in that the cylindrical component or pin, after fitting, is driven down through the pronged component to wedge the prongs apart for positive lock.

Insulet rivets are produced from Grilon caprolactam nylon by Standard Plastics Co., Inc., Attleboro, Mass., for Pylon Co. of the same city. These rivets are used chiefly to date for electrical and electronic component assembly where a mechanical connection must be maintained but an electrical connection must be prevented. The tiny hollow-shank metal rivets have shank and underlip covered with nylon. They can take relatively high temperatures, are good dielectrically, are tough and pliable enough for rolling over during the riveting operation, and have good frictional properties for ease in feeding through automatic riveting machines.

A problem in manufacturing these items and similar small and critical units is tooling and molding procedure to secure nylon wall thicknesses of 0.015 in. and to maintain perfect concentricity between inside and outside diameters of the sleeves in a fantastic number of cavities. Standard Plastics uses a 1-oz. injection machine especially designed for extremely close control of pressure, temperature, and plasticizing on this job.

There are a number of standard lines of nylon bolts, nuts, and screws on the market. An important line is produced by Anti-Corrosive Metal Products Co., Inc., Albany, N. Y., pioneers in the stainless steel fastener field and pioneering all over again in the nylon field. Called

It's not only what you have molded



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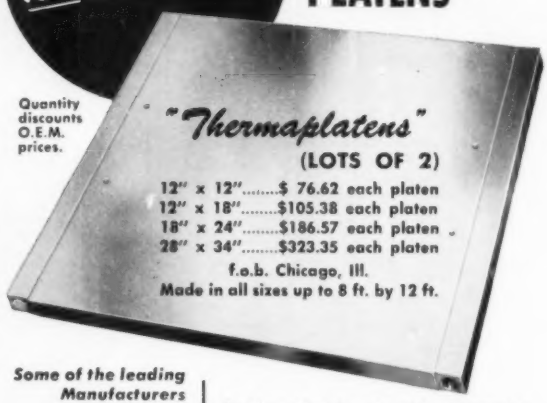

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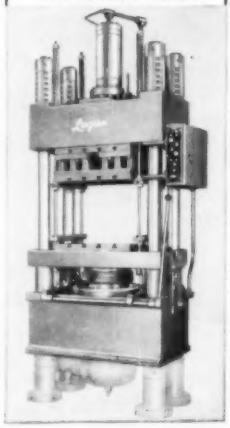

HYDRAULIC DIVISION
LOGAN ENGINEERING CO.
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Nylo-Fast, the nylon bolt and nut line embraces 200 standard items, used largely where wear and abrasion resistance, low coefficient of dry friction, resiliency, light weight, corrosion resistance, high-voltage electrical insulation, and heat resistance are factors.

A new line of nylon fastenings designated Nylogrip has been announced by Nylogrip Products, Newton, Mass., especially engineered to replace aluminum at less weight in the electronic, aircraft, chemical processing, and instrumentation industries.

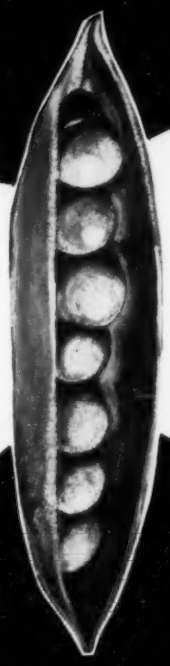
A line of strain-relief bushings has been made for several years by Heyman Mfg. Co., Kenilworth, N. J. The purpose of these items is to hold electrical wire and cable tight and immovable at the point where they enter appliances such as radios, refrigerators, and television sets so that a pull on the electrical conductor will not be transferred to delicate components. In establishing its line of Heyco strain-relief bushings, the company considered many types of both thermosetting and thermoplastic materials, and finally settled on nylon. The bushings were approved by the Underwriters' Laboratories and the Canadian Standards Association and were probably the first made from a thermoplastic material to be so approved. Up until a few months ago the product was made in two parts, but inventory control of matching parts in electric and electronic assembly plants was most difficult, with millions of items involved. Now the two components are molded in one piece with, literally, a molded-in flash linking them.

Standard Sections

Processing companies mentioned heretofore in this article have set up standard production of extruded sections, rods, and tubes for service to fabricators who machine them into gears, bushings, bolts, nuts, and other things. It is possible to obtain stress-relieved rod and moisture-stabilized sections from these specialists. They also are expert in coloring, blending with additives, and other phases which are frequently important to highly specialized application. One of these companies, Polymer Corp. of Pennsylvania, is building a remarkable business in extruded nylon tubing

colors for the plastics industry...

as uniform as peas in a pod



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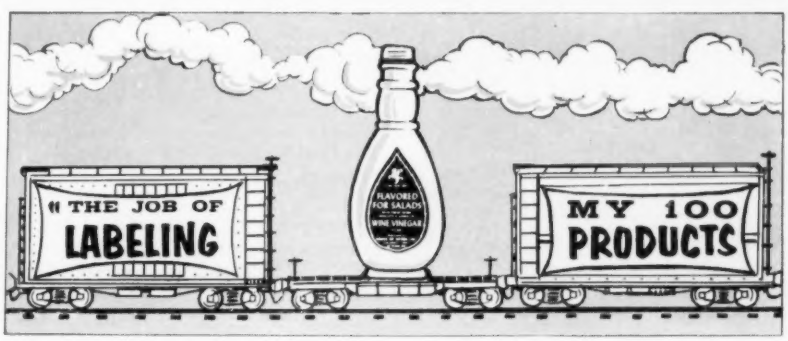

has always been in the hands of Ever Ready," says Mrs. Ezra Winter, President of House of Herbs. "I remember the first rough label designs I sent you 13 years ago . . . they were for Mixed Herb and Garlic Wine Vinegars.

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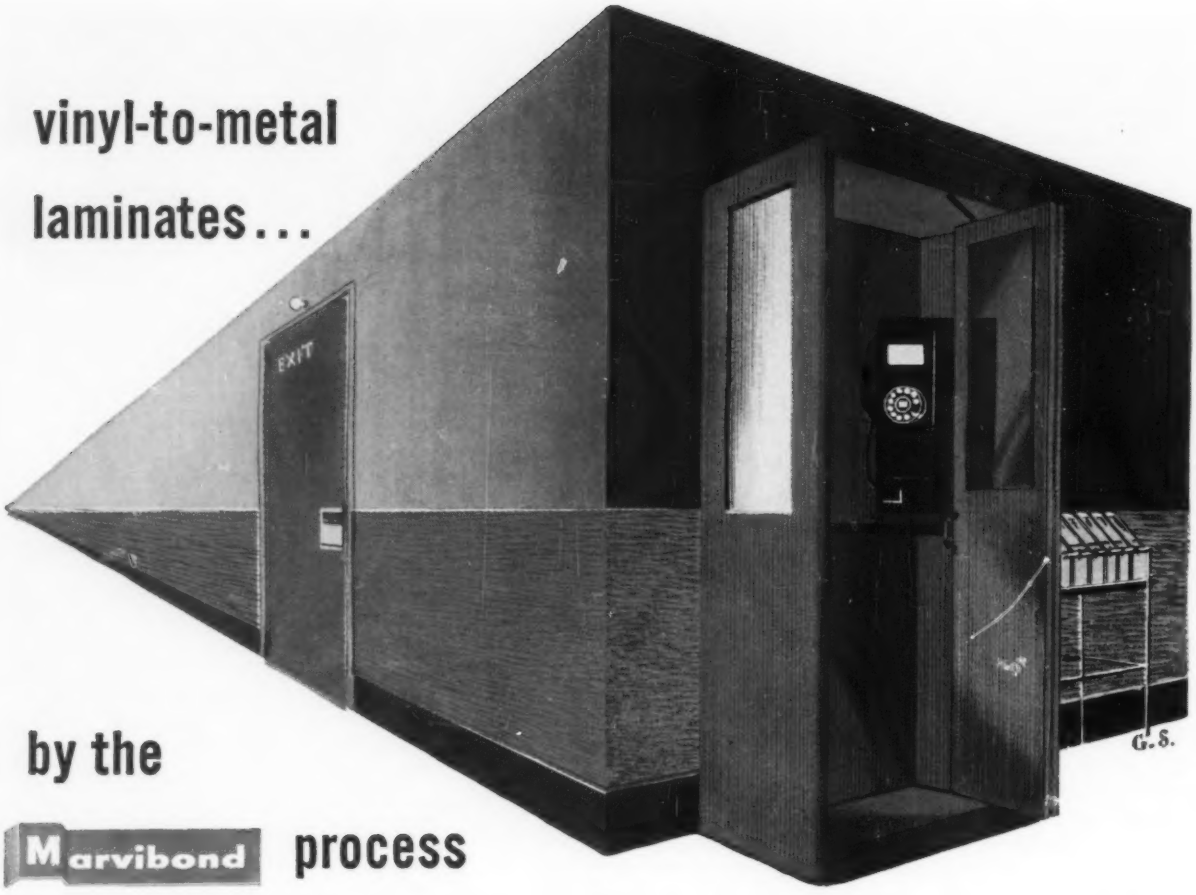

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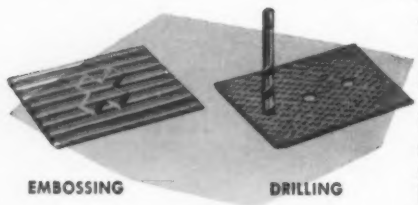
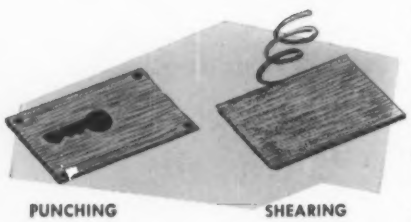

EMBOSSING DRILLING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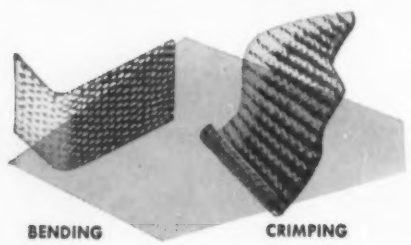
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for automotive lubrication systems. Trademarked Nylaflow, this tubing flexes without fatigue, will not corrode, serves over a wide temperature range, may be used with standard automotive lubrication fittings, and is ideal for prefabricated assemblies. It is standard today on the 1955 Lincoln and Mercury automobiles in a push-button lubricating system engineered by the Lincoln Engineering Co., St. Louis, Mo. Other automotive manufacturers are expected to follow and a great deal of development work is being done on the use of extruded nylon tubing in hydraulic, air, and even cooling lines.

Markets Wide Open

As pointed out in the January 1955 issue of MODERN PLASTICS, nylon's recently acquired versatility has led it into some most unusual applications including horseshoes and heel inserts for workmen's boots. From all the foregoing it is obvious that markets are wide open for well engineered applications of nylon materials. As more molders and fabricators become better acquainted with these materials, their advantages, their limitations, and the special engineering problems involved in their use, the juvenile genuis material of yesterday mentioned in our opening paragraph will become the solid leading resin citizen of tomorrow.

References

For further details on properties and processing of nylons, the reader is referred to the following articles in the MODERN PLASTICS Encyclopedia issue, Volume 32, No. 1A, 1954:

"Nylon (Polyamides)," p. 509; "Injection Molding of Nylon," p. 67; "Extrusion of Nylon," p. 116; Coatings Chart, p. 794; Fibers Chart, p. 800; Films Chart, p. 806; Plastics Properties Chart.

The following articles dealing with nylon have appeared in MODERN PLASTICS since September 1954:

"Nylon Bushing," MODERN PLASTICS *32*, 208 (Sept. 1954)

"Nylon in Cameras," MODERN PLASTICS *32*, 210 (Nov. 1954)

"Materials Supply and Demand—Nylon," MODERN PLASTICS *32*, 82 (Jan. 1955)

For articles on nylon prior to September 1954, see the annual index.

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Drive-in Movies

(*From pp.* 108-110)

pregnated fibrous glass by Eprad Co., Electrical Products Research and Development, Toledo, Ohio. Available in a range of two-tone color combinations, the reinforced plastics speaker cases are claimed to offer, in addition to high impact strength and good tonal qualities, outstanding resistance to outdoor weathering. A number of the speaker cases have now been in use for several months in the arid climate of Tucson, Ariz., with no reported failures.

The two halves of the speaker case are matched-metal molded in a 50-ton press and bolted together. The rear arm which holds the case on the car door is molded separately.

Junction box covers marketed by Eprad are molded in translucent green, red, amber, and blue using Hercocel cellulose acetate supplied by Hercules Powder Co., Wilmington, Del. In keeping with the emphasis on the use of weather-resistant plastics, the base for the junction box is molded of reinforced plastics. Heretofore, die-cast aluminum bases have been used.

Polyethylene Covers

During the winter months when many drive-ins close down, there is need for additional protection for speaker housings against the weather. For this purpose, a polyethylene film cover for all types of speakers has been developed by Central States Paper and Bag Co., St. Louis, Mo.

The covers will effectively protect the speaker case and speaker unit from sleet or snow. The polyethylene film, which is supplied by The Visking Corp., Plastics Div., Terre Haute, Ind., is exceptionally tough and will not become brittle at temperatures down to −60° F. The covers fit snugly over the speaker cases and are taped on at the bottom.

Theater operators who take their speakers indoors during the winter months also use the covers to protect the speakers from dust and dampness.

Plastics Screens

Molded or fabricated screens are the latest use of plastics in drive-in movie theaters. The conventional drive-in screen is generally made up of a steel framework faced with sections of exterior plywood, asbestos board, masonite, or metal—all painted bright white.

Although this type of screen has been in use from the early days of the drive-ins, it has always been unsatisfactory in many respects. The steel tower, as it expands or contracts with heat or cold, may open up seams as large as ¼ in. between sections. Also, the life of the bright white finish of the facing surface is relatively short. After exposure to weather for several weeks, the white paint becomes dull-looking and may begin to chip or peel. The facing material itself, under outdoor weathering, also may begin to break down, causing distortion of the picture.

National Tank Co., Tulsa, Okla., believes it has solved the problem by using facing sections molded of polyester resin-fibrous glass laminate. According to National Tank Co., and Natco Wonder Screen Co., Dallas, Tex., distributors of the screen, the reinforced plastics facing material has several outstanding advantages. Since the large 8- by 8-ft. plastics sections have a certain degree of elasticity and are bonded together with epoxy resins, the possibility of seams opening up between sections is remote, even though the supporting steel framework does expand and contract. The tough sections are also exceptionally weather resistant, will not warp or buckle, and are claimed to give 30% more light reflection than the conventional drive-in screens, better illusion of depth, more contrast in black and white film, and more brilliant reproduction of color.

Two types of reinforced plastics screens have thus far been installed —a solid laminate of resin and fibrous glass and a sandwich construction with reinforced plastics faces and a plywood core. To facilitate installation of the 8- by 8-ft. panels, the steel framework is constructed with connecting members at 8-ft. intervals across the front from top to bottom. Each section is fastened to the structural frame with flat head screws or bolts. The seams are then filled with epoxy resin, pigmented white, and sanded smooth. In some cases, a woven glass tape, impregnated with epoxy resin, is used to seal off the joints.

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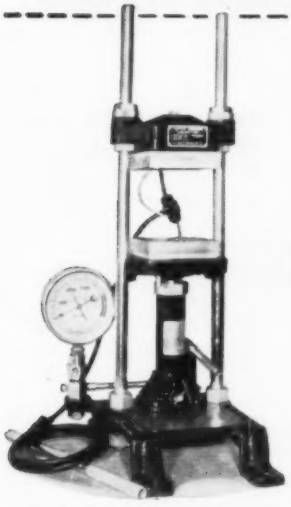

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types of screens is, reportedly, the one based on the sandwich construction. Glass mat pre-impregnated with weather-resistant polyester resins and exterior plywood dried in an oven at high temperatures are used. The sections are molded in a large flat steel platen press, using pressure and heat, to make each section uniformly ½ in. thick throughout. After trimming to size, the edges are painted with an epoxy resin to prevent absorption of water by the exposed edges of the wood core.

Over 20 installations in Texas, Oklahoma, and Missouri of reinforced plastics Cinemascope screens have been in successful operation for over a year.

Vinyl Sheeting

Another type of outdoor motion picture screen is made of vinyl sheeting in sizes from 30 by 50 up to 40 by 80 feet. The vinyl sheet, as fabricated and heat sealed by Plastic Creators, Little Ferry, N. J., is simply stretched across the solid facing sections. It is claimed that the integral bright white color of the vinyl sheeting will last for years without dulling or fading and that it makes for excellent viewing conditions. Even rain, which distorts the picture on conventional screens, does not affect reproduction of the movie on the vinyl screen. In fact, rain is useful as a means of washing the screen clean.

Other advantages claimed for the vinyl screen: it can be stretched tight to provide a smooth, wrinkle-free surface; it can be easily installed by simply lacing it into place; and it has a service life of between 2 and 5 years.

The oldest installation of the vinyl screen—in the hot, dry climate of Tallahassee, Fla.—was made almost a year ago and results to date have been excellent. The tough vinyl sheeting, especially formulated for outdoor use, is supplied by General Tire & Rubber Co., Akron, Ohio.

Individual Screens

A variation on the use of vinyl as a motion picture screen has been developed at Dallas Theater, Urbana, Mo. Instead of using one large screen that faces the entire open air theater, each car has its own individual small screen set up in front of it. Rear projection is used for each screen.

The 12-gage Krene vinyl sheeting, supplied by Bakelite Co., which is used, is stretched drum tight across a wooden frame, 36 by 48 in. in size, and is tacked and glued around the edges. The entire frame is then snapped into place on an upright holder in front of each parking station.

According to the operators of the Dallas Theater, vinyl sheeting is one of the few materials which can be stretched drum tight across a frame and will not loosen even in the hot sun. The vinyl sheet is also unaffected by heat, sun, wind, or cold weather and is claimed to produce a truer, sharper, and brighter picture than most other types of sheeting.

With the introduction of these three new basic types of screens, the application of plastics in the drive-in movie theater continues to grow in scope. Thanks to plastics, the operator of the drive-in can now boast that the equipment he uses, like the movies he shows, are both "better than ever."—END

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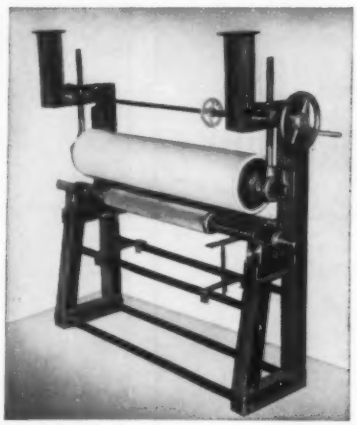

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Polyurethanes

(*From pp.* 102-104)

lecular-weight polymer into a high-molecular-weight elastomer plastic. At the same time, the diisocyanate reacts with the water to generate carbon dioxide which foams the resin. The density of the foam is controlled by the amount of water and diisocyanate used.

In addition to the major ingredients, other materials, such as catalysts and emulsifiers similar to household detergents, may be added to control the rate of foaming and the cell structure of the foam. Time and degree of mixing must be carefully controlled, which can be done best on suitable machinery.

The machines cost from $6000 to $45,000. As much as $12 million worth of flexible foam can be turned out in a year from the latter. Anywhere from $500,000 to $1 million is thought to be the investment required before a successful business of this type can be inaugurated.

Flexible Foam Costs

Cost of urethane flexible foam is at present a difficult matter to comprehend because of all the varied involvements, but producers are confident that it will compete with latex.

Isocyanate chemicals of the toluene type are now $1.20 a lb. in the United States. The polyesters are about 60¢ a pound. The combination of materials put into the machine before foaming consists of about 100 parts polyester, 35 parts isocyanate, and 7 parts pigment, etc.

Presently imported urethane foam is about $1.55 a lb., including duty. Material for rubber latex foam costs between 38 to 42¢ without scrap losses, has been as low as 33 cents. Good latex foam in the normal market sells for about 75 to 90¢ a lb., but it weighs about 6 lb. a cu. ft., whereas comparable urethane foam is 2.1 to 3 lb. a cubic foot.

Urethane raw material costs for foam run between 75 and 80¢ a lb., but this cost must be weighed against the factor that urethane foam of equivalent compression loading will weigh about half as much as latex foam. Consequently, the cost of the two foams for upholstery or seating are about equal in thick sections. Furthermore, since urethane

is easier to cut or sheet in thin sections such as used for rug underlays, the cost is lower than latex and competitive with hair felt.

Rigid Foams

Rigid polyurethane foams are the next best known member of this family in the United States. In Germany, panels consisting of two sheets of aluminum with a urethane core are being used experimentally in railroad cars. The urethane is durable enough to stand high compression, makes a good foamed core between almost any wood, metal, or plastic surface, and, if desired, can be foamed in place without the use of an adhesive. It is being used in Europe in metal-urethane-metal sandwiches for the construction of containers used in the transportation of perishable foods. Radomes and airplane wing tips are other possibilities; in the latter case, it is possible to use a formed metal outer skin and fill the inside with the isocyanate and polyester chemicals which, when foamed, fill the entire wing tip with a rigid urethane core.

Rigid polyurethane has as good a thermal insulating value as almost anything known. It is more expensive than polystyrene foam or glass wool, but when used as a sandwich material in a structural part, it can be less costly than competing materials. In a truck trailer body, for example, thin aluminum sheets with a urethane filler can reduce body weight and hence increase the pay load. Wherever weight-strength structure is needed, urethane foam can become a competitive factor. And, because it can be foamed in place, it can be used in spots difficult to reach, such as bulkheads in boats and in refrigerators or on low-temperature pipe lines where it is reported to be less costly than cork.

None of the above applications for insulation have as yet achieved volume use, but they give an indication of the possibilities toward which producers are shooting.

Molding Possibilities

One of the unusual uses for polyurethane which has received little notice is its possibility as an injection or compression molding material. Such uses are far from ready for exploitation as yet, because development work is still under way. This particular urethane is a thermoplastic. It contains no polyester, but includes a glycol along with the diisocyanate. The properties and performance are similar to nylon.

Polyurethane molding material exhibits less water absorption than nylon and has a lower melting point in the mold. Its heat distortion point is about the same. It will not oxidize in a molten state while in the air. However, cost of polyurethane molding material is likely to remain higher than nylon unless increased production of certain chemicals results in marked price reductions.

A fiber made from this same type of polyurethane is also a distinct possibility in the future.

Surface Coatings

In Europe, polyurethane is used for surface coatings almost as much as for foam. It is expected that new magnet wire enamels made from urethane resins will be marketed in the United States this year. They will have high moisture resistance and a high-temperature resistance of more than 265° F. In addition, they can be soldered without stripping off the insulation. Wire coaters operating with 40 to 50% solids can use dies, felt wipers, or dip-coatings to apply the enamel. It is quite possible that urethane will even compete with the very special vinyl-formal compounds now used for highest-grade wire coatings.

Polyurethane paints have many possibilities. Their chemical and solvent resistance is well established. When specially compounded for a specific surface, their abrasion resistance is claimed to be superior to most any other coating, including epoxies. Their heat resistance is claimed to be greater than that of any other resinous coating, except silicone.

Coating materials are generally furnished in two components that can be mixed together by the user and can be air-dried. A one-component mixture is available for baking enamels that can be applied at 280° F.

These various coatings have been used on plaster, plaster board, aluminum, concrete, mastic, and hard asphalt floors. (A racing scull coated with urethane has withstood seven years of wear.) They are also suggested for coating oil tanker linings; for floors and tank linings in steel and chemical plants; and for milk

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Other applications (please list) _____

and fruit juice equipment linings where glass and vitreous materials are used now.

Because of cost, the urethane coatings are presently limited to industrial finishes but will compete with epoxies and other high-grade coatings in that field. They are not yet suitable for dead white enamels like that on refrigerators, but researchers expect to correct that problem before long.

Adhesives

Urethane adhesives are still another possibility for the future, but cost and concentration on other urethane developments have held back their promotion. It is well known that urethane adhesives have exceptional "sticking" properties, but the problem is to make them more practical from an economic viewpoint. They are currently being suggested as additions to neoprene and other rubber cements to increase heat resistance; for bonding leather to leather, rubber to rubber, and leather to rubber. Shoes have been made in Germany using urethane adhesives without an inch of stitching.

Possibly the largest use for polyurethane will develop later in synthetic rubber. Vulcollan, a rubber of this type, is already fairly well known in Germany. Some prognosticators say that the first 100,000-mile tire will eventually be based on polyurethane, but the day when that may happen is a long way off. The material is being tried successfully in hard tires on industrial trucks, such as those used in inter-plant movement, but is still in its infancy for that development. Its use for shoe soles and heels is already well advanced in Germany.

Many Types, Many Uses

Attention should be called to the fact that there are numerous types of isocyanates and polyesters which can be combined to form polyurethane resins that will probably result in many variations not mentioned here or not even known at present. The most common and lower-cost type of isocyanate is the toluene type described above. Other types are developed from naphthalene (for rubber), anistidine, benzedine, and other materials. The family is large and new babies are on the way.—END

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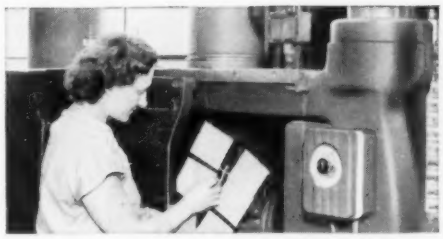

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Plastics Structures

(*From pp.* 139-148)

material property required is expressed as

$$G_m J/L = G_m \pi D^4/32L \geq T/\theta \quad \text{Eq. 48}$$

Minimum weight requires

$$w = \gamma_m L \pi D^2/4 \quad \text{Eq. 49}$$

Eliminating D between Eq. 48 and 49 and taking the minimum:

$$w_{min.} = (2\pi L^2 T/\theta)^{1/2} (\gamma_m/G_m^{1/2}) \quad \text{Eq. 50}$$

The relative weight of shafts made of materials 1 and 2 for the same functional specifications is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/G_1^{1/2}}{\gamma_2/G_2^{1/2}} \quad \text{Eq. 51}$$

C. Adequate resistance to deformation from impact on a single beam

The functional specifications are: length L; rectangular cross-section energy load U due to impact of concentrated load with maximum value P at center of beam; and minimum weight. Implied material property:

$$(I/6c^2)(L/E_m)(\sigma_m^2) = (bhL/18)(\sigma_m^2/E_m) \geq U \quad \text{Eq. 52}$$

Minimum weight requires

$$w = \gamma_m bhL \quad \text{Eq. 53}$$

Eliminating bhL between Eq. 52 and 53 and taking the minimum:

$$w_{min.} = (18U)(E_m \gamma_m/\sigma_m^2) \quad \text{Eq. 54}$$

The relative weight of beams made of materials 1 and 2 for the same functional specifications is:

$$\frac{w_1}{w_2} = \frac{E_1 \gamma_1/\sigma_1^2}{E_2 \gamma_2/\sigma_2^2} \quad \text{Eq. 55}$$

D. Adequate resistance to large amplitude vibration in a short tension bar supporting a vibrating load*

Specifications are: axial load fluctuating sinusoidally with amplitude P_o at resonant frequency on a tension bar of length L; and minimum weight. Implied property required is:

$$C_m E_m \sigma_m^{n_m - 1}/\pi \geq P_o/A \quad \text{Eq. 56}$$

where C is the coefficient and n is an empirical number in the equation $\psi = C\sigma^n$ for the damping capacity, ψ, of the material, and σ is the amplitude of completely reversed stress cycles. Minimum weight requires

$$w = \gamma_m AL \quad \text{Eq. 57}$$

Eliminating A between Eq. 56 and 57:

$$w_{min.} = \pi \gamma_m P_o L/C_m E_m \sigma_m^{n_m - 1} \quad \text{Eq. 58}$$

The relative weight of bars made of materials 1 and 2 is:

$$\frac{w_1}{w_2} = \frac{\gamma_1/C_1 E_1 \sigma_1^{n_1 - 1}}{\gamma_2/C_2 E_2 \sigma_2^{n_2 - 1}} \quad \text{Eq. 59}$$

*While a completely satisfactory method of designing to resist vibration is not available, the relation given may be derived by equating the energy input by sinusoidal motion at resonance to the energy absorbed in internal friction of the material. It is assumed that the latter is proportional to some power, n, of the stress for elastic stresses and that all the deflection of the system is uniformly distributed along the bar.

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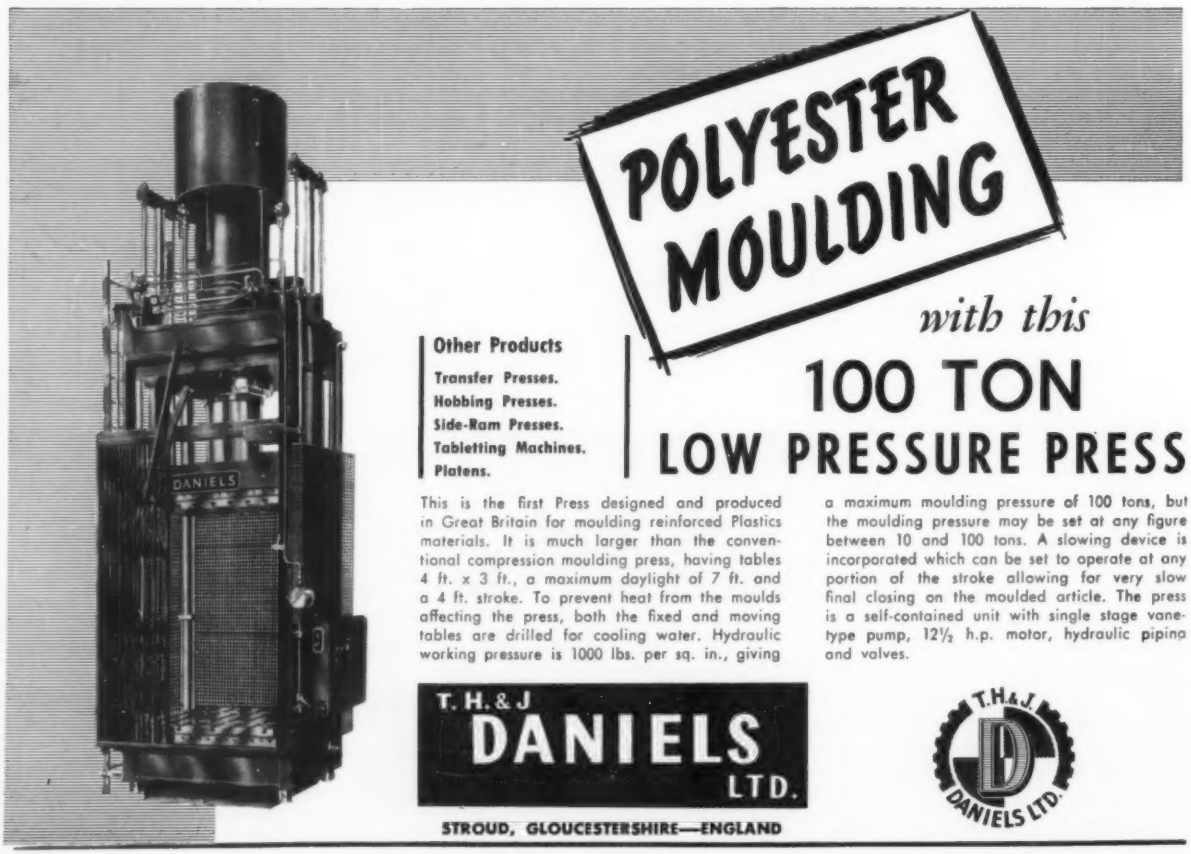
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With Sodium

(*From pp.* 150-152)

dium reduction of low cost fats and oils are normal (straight chain) materials containing from 8 to 22 carbon atoms, with 16-carbon and 18-carbon chains predominant. These alcohols are generally soluble in ethyl alcohol, ether, benzene, and glacial acetic acid, and they are generally insoluble in water. They are non-corrosive, non-toxic, and offer no special problems in handling.

Stabilizers for Vinyls

Organotin compounds, among the best stabilizers for vinyl plastics, have been prepared by two general techniques using sodium metal as an intermediate.

The first of these two methods involves the reaction of a sodium-tin alloy with an alkyl halide according to the type reaction:

$$4\ NaSn + 4\ RX \rightarrow SnR_4 + 4\ NaX + 3\ Sn$$

as described by Lowig (14).

A second and more recent technique is a Wurtz-type reaction between stannic chloride, an alkyl halide, and sodium according to the equation:

$$SnCl_4 + 4\ RCl + 8\ Na \rightarrow R_4\ Sn + 8\ NaCl$$

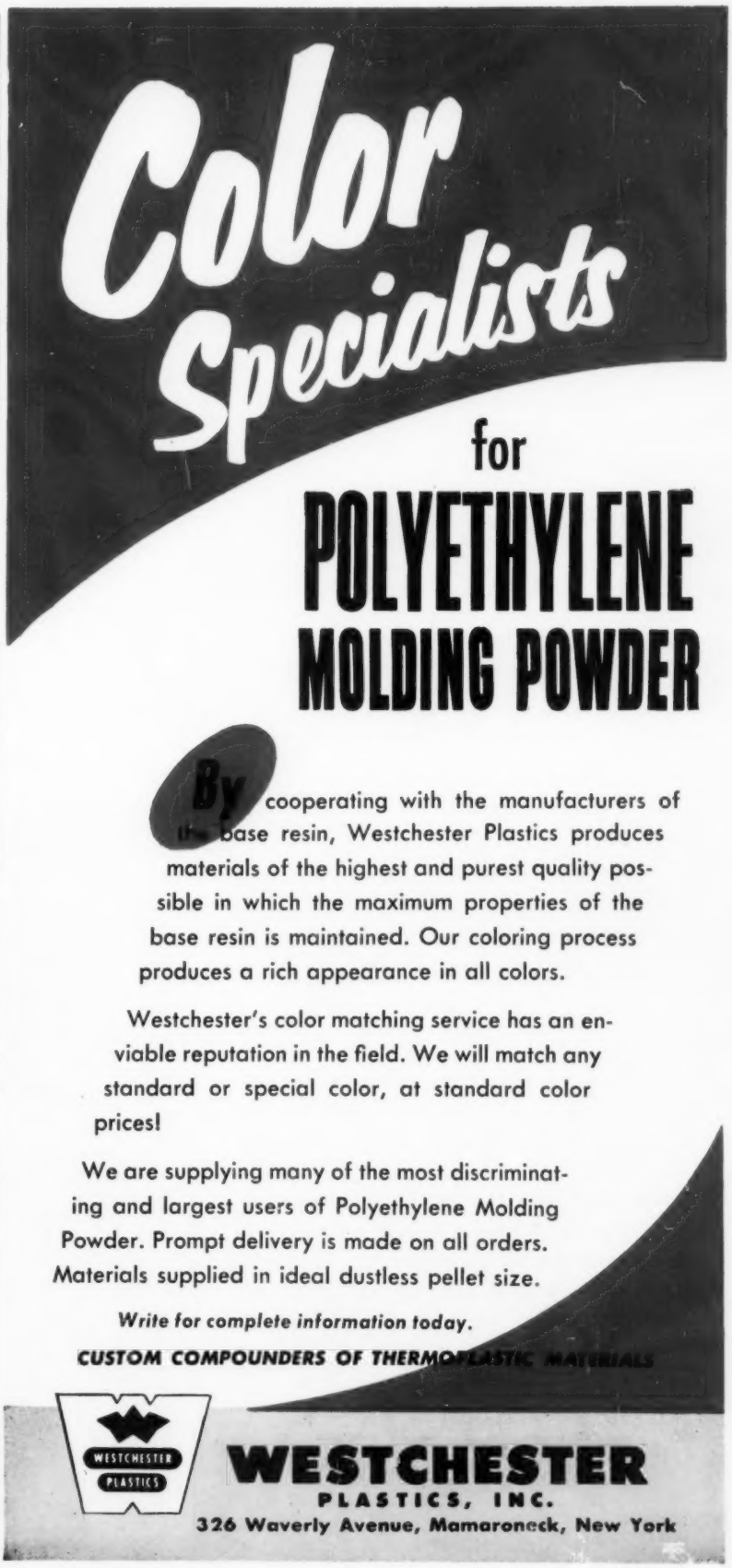
as described by Van der Kerk and Luijten (15).

Sodium for Heat Transfer

In addition to being a very reactive and versatile chemical intermediate, sodium is unique in that it also is an excellent heat-transfer agent (sodium melts at 208° F. and some sodium-potassium alloys at room temperature). Sodium and sodium-potassium (NaK) alloy have heat-transfer coefficients that are among the highest known. They are extremely stable, in that they do not polymerize, carbonize, or decompose. Also, they are not corrosive to ordinary steel equipment.

One possible application of sodium or NaK is to the heating of reaction kettles, such as those used for cooking varnish. Such kettles are often heated with Dowtherm to temperatures of 400 to 600° F., but they could be heated to 1200° F. by circulating NaK alloy, according to Katz (16). The NaK could be heated by electric heaters or with a direct-fired heater.

Applications of sodium or sodium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alloys to heating plastic molds may be a possibility in view of the considerable interest shown in the control of glass mold temperatures in this manner. Glass molds operate at 800 to 1200° F. and precise control of mold temperatures is often desired. A proposed NaK circulating system having two liquid metal loops operating at different temperatures for precise control of glass viscosities at different points in a mold has been outlined by Katz (16).

Sodium Handling Techniques

Many of the chemical uses of sodium have long been known. Until the last few years, however, sodium handling techniques had not been developed that permitted these reactions to be carried out safely and easily on an industrial scale. However, work by the Atomic Energy Commission and by contractors to that agency has resulted in the availability to industry today of workable designs for pumps, flowmeters, heat exchangers, and filters. An excellent summary of this is available in the Liquid Metals Handbook (17). There is also available a variety of manufacturer's literature describing in detail the handling of metallic sodium (18) as well as the use of sodium in dispersions in inert hydrocarbons (19).

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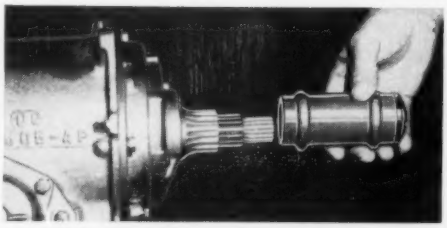

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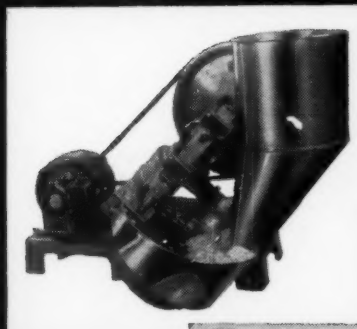

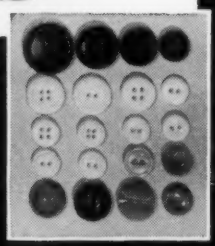

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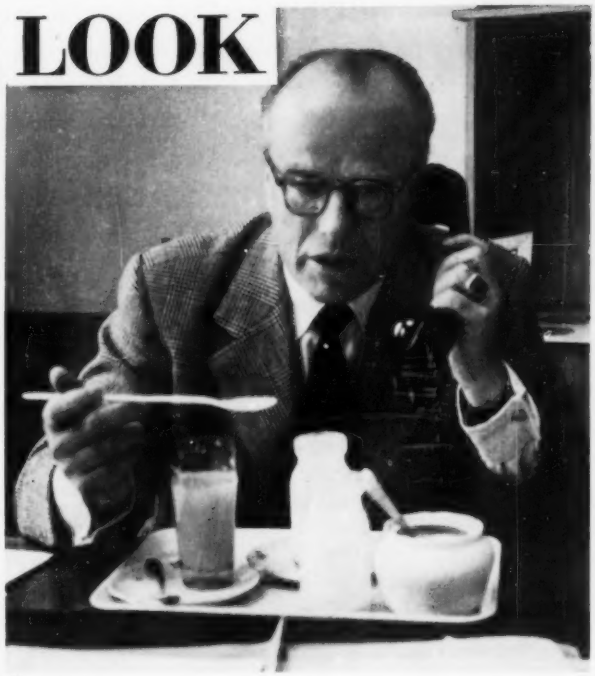


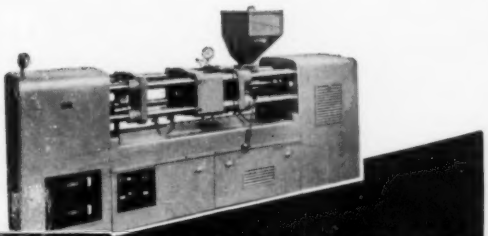
* LOOK Magazine photo

LOOK says in the January 25 issue under the heading, "What's behind the German comeback?":

"Carl Gisbert Siebel . . . is what we Americans would call a small businessman. His company — it makes injection molding machines and molds for plastics — employs about 150 workers and does no more than $500,000 worth of business a year. But plants like Siebel's are the backbone of Germany's industrial might . . . (His own plant now exports 30 per cent of his production to 16 countries on four continents; a third of it goes to the United States.) With their higher efficiency, lower labor costs and intensively developed skills, the Germans started out with a handful of trumps. Aggressive salesmanship and honest sweat have done the rest."

And now C. G. Siebel asks on his own account:

When is one of our machines going to you? I pointed out last month that our injection molding machines are individually powered. Plug into any socket, and they're ready to go. Their special feature is completely hydraulic oil operation; we have developed a convenient wholly or semi-automatic attachment. We make $1\frac{1}{2}$, 2, 5, and 12 ounce machines. Drop me a line for complete details — no obligation, naturally.



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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Vinyl Chloride Price Breaks

DRASTIC reductions of prices of vinyl chloride resin, initiated by Bakelite Co., a Div. of Union Carbide and Carbon Corp., and followed by other producers, was the big news of the month in the plastics industry.

Vinyl prices have always varied somewhat, depending on the type of material purchased. But by far the largest quantity is that used for calendering and extrusion in such products as film, sheeting, wire coating, garden hose, extruded profiles, and other extrusion products. Until June 27, resins used for these purposes sold for 38¢ a pound. They are now 31¢ a pound. Resins for plastisols that were previously 41¢ are now 34¢ a pound. Organosols dropped from 38 to 32 cents.

Solvent types of resins made by Bakelite were reduced only 1 to 3¢ a pound. These are used for can coatings, phonograph records, and floor tile. Before the price reduction, they varied from 38 to 46¢ a lb.; now they vary from 35 to 45 cents. Also, these are the resins which have been somewhat "tight" in today's booming vinyl industry.

The specially tailored low cost resin used for most other vinyl floor coverings than tile is now 25¢ a lb. in contrast to the former 29¢ price. This is particularly significant in that it points up the ability of the industry to formulate a resin for a particular job where it is obvious that lower cost with adequate quality will result in capture of a major portion of the market.

Maximum Reductions—Generally speaking, resins used for unplasticized vinyl sheet and pipe were reduced the maximum amount, but only a purchasing agent could appreciate the over-all extent, since there are so many compounds and modifications in this classification.

Vinyl chloride compounds of all types made by resin producers have been reduced to correspond with the resin price reduction. Bakelite also announced that Krene vinyl film would be reduced from 56 to 52¢ a lb. in truckload quantities and that sheeting would be reduced from 55 to 51 cents.

The reasons given for reduction of prices, as outlined by C. W. Blount, vice president in charge of Bakelite sales, were to expand the market for vinyls; to absorb excess capacity for production of resins now in existence; and to compete with foreign vinyl resins that have been coming to the United States in ever-increasing quantity at a price of around 30¢.

Competition—It is believed that about 415 million lb. of domestic vinyl chloride resin and between 10 and 15 million lb. of imported material were consumed in the United States in 1954. But the capacity of the industry is thought to be somewhere between 600 and 650 million pounds. In addition, new capacity for some 125 million lb. or more is being planned, but there is some question as to whether or not all of it will be built in the near future. Furthermore, present producers could increase capacity quickly if they so desired, and in many cases their present facilities are almost completely amortized.

So far in 1955, foreign resin has been coming in at a rate of 1.5 million to over 2 million lb. a month. Most of it was from Italy, but even a small trickle has started from Japan. There are 10 or 12 vinyl chloride plants in foreign countries and some of them have their eyes on the market in the United States. From now on they will have to contend with a much different price structure.

It is also possible that the drastic price reduction is aimed at prospective new entrants in the field who have looked hungrily at the difference between vinyl monomer prices of 10 or 11¢ and the 38¢ price for polymer. If so, present producers have now emphatically shown that no such spread will exist in the future. Even further price cuts may be anticipated if resin sales should decline, if there is another opportunity to capture a new market by specially tailored low cost resins, or if competition gets even more rough and tough in an industry where capacity to produce can be kept well ahead of demand.

Inventory Factor—Industry members were generally surprised at the amount of the cut and to have it come at a time when sales were booming. One favorable factor noted was that inventories of domestic resin in users' plants were comparatively low due to anticipation of a summer lull. On the other hand, inventories of foreign resin in several users' plants were reported as heavy.

The vinyl chloride industry has been selling resin at a rate of around 550 million lb. per year ever since January. The big increases have been in extrusion—largely for wire coating, floor coverings, and fabric coating. The latter has been consuming resin at a rate of almost 50 million lb. a year, compared to a little over 40 million lb. last year. From less than 150 million lb. in 1954, the rate for extrusion and molding resins in 1955 has gone up to almost 190 million pounds. Of this amount about 100 million lb. may prove to have been for wire coating when the year ends. Floor covering resins have grown from 35 million in 1954 to a more than 50-million lb. rate so far in 1955. Film and sheeting volume looks as though it would be about the same in 1955 as in 1954. July and August over-all operations are generally curtailed and may make considerable difference in the 1955 outlook for total vinyl chloride sales. But no one is expecting more than a seasonal decline, although it is still too early to predict that as much as 550 million lb. will be sold in 1955. No one is sure that the last half of 1955 will be as good as the first half.

Still another important factor in this field is the export business which will probably total between 30 and 40 million lb. this year. Most producers feel that this market is a temporary one due to the large number of foreign producers who will soon be operating full scale.

Conclusion—An outstanding reason for the price decline in a booming

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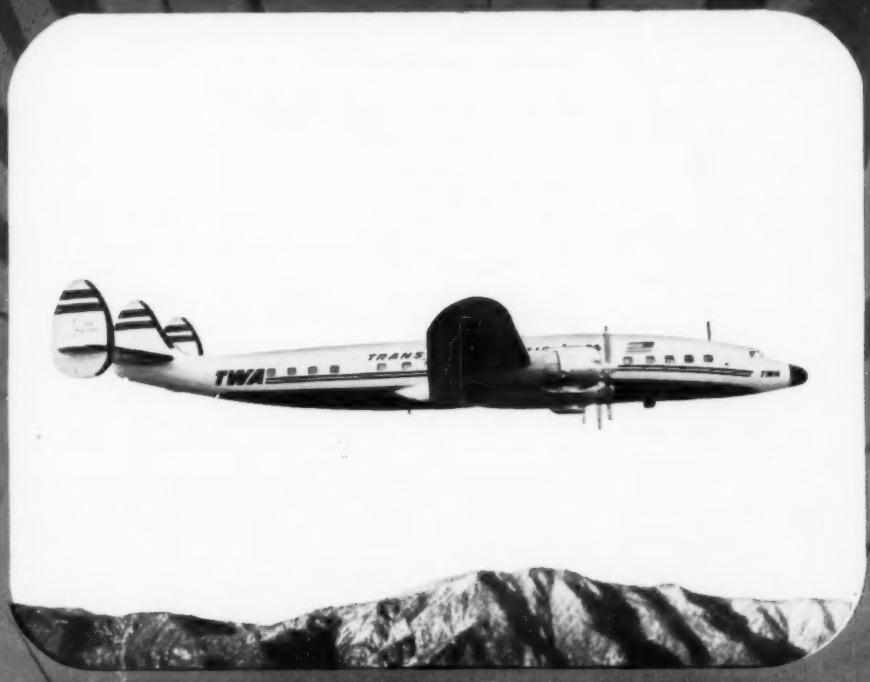

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market is that present producers are warning prospective newcomers that they will not supinely submit to overgrazing in their green pastures. There is no guarantee that the pasture will always remain as green as it happens to be now. But if it does, present producers can increase their capacity quickly and sell their goods at a price level that discourages any prospect of high profit.

Acrolein

A PRACTICAL route to a "pyramid of chemical intermediates" useful in making a host of products ranging from plastics to pharmaceuticals to poultry feed supplements has been opened by new research in the chemistry of acrolein.

Shell Development Co. has announced that large-scale production of this material will now be started after 20 years of research. Acrolein has been known for over a hundred years as a potential starting point in the synthesis of many useful products, but it has always been scarce and expensive. The Shell development permits commercial production of acrolein from air and propylene, a product of oil refining.

Shell Chemical Corp., 50 W. 50th St., New York 20, N. Y., has announced plans for the construction of an acrolein plant in Norco, La., to operate in conjunction with a hydrogen peroxide unit for the production of glycerine. Assured use in this process is expected to make possible the manufacture of additional quantities at low cost.

A company spokesman states that acrolein, because of its great versatility, seems destined for a place along with ethylene oxide, acetone, and allyl chloride as a petrochemical serving almost all branches of the chemical industry.

Epoxy for Injection Molds

SAVINGS of thousands of dollars in mold costs is predicted by Adams Plastic Products, 309 Findlay St., Cincinnati, Ohio, as a result of work being done with injection molds made of a new high-temperature-resistant epoxy casting resin. The molds, Adams claims, are proving equal to fine polished metal molds. Without machining—and at a fraction of the cost of metal molds—the plastic molds can be accurately poured directly to wood models, plasters, or actual parts.

One Adams mold, built in three days by pouring the new casting resin directly to prototype parts, cost approximately $200. The cost of a comparable machined metal die is estimated to be about $1500 to $2000. The die produced over 65,000 pieces (polystyrene) in 18 hr. of continuous operation with perfect reproduction.

Kish Resins, Inc., Lansing, Mich., manufacturer of the new high-temperature-resistant resin, is releasing the material on an experimental basis. The company states that as soon as more complete information is available, it will be able to recommend it for other applications, such as heated matched molds, heated mandrels, vacuum molds, etc.

Vinyl Joints for Sewer Lines

COMPLETELY rootproof, watertight, clay sewer pipe lines are now possible with new Koroseal molding compounds that permanently seal joints between lengths of pipe. Made by The B. F. Goodrich Co.'s Industrial Products Div., Akron, Ohio, the compounds are supplied in liquid form to clay sewer pipe manufacturers who process the material into tough but flexible sealing rings. For ease of installation, the vinyl materials are specially made to remain flexible at low temperatures yet firm in hot weather.

President of BFG's Industrial Products Div., Clyde O. DeLong, states that contractors receive the new pipe with rings of Koroseal material molded permanently at the ends of each pipe section. At the shaft end of the pipe, a Koroseal ring is molded to the outside surface; at the bell end of the pipe, a Koroseal ring is molded to the inside surface of the bell. When the two ends are pushed together, the rings squeeze tightly against each other to form a compression seal that remains effective far longer than any other known pipe-joint sealant.

With the development of the new Koroseal joint, the company foresees a new market for clay sewer pipe in the disposal of industrial chemicals. Clay sewer pipe has always resisted many types of chemical waste products, but conventional sealing materials soon fail in such service.

BFG expects that pipe with the new seals will be available eventually to home owners on a do-it-yourself basis, but distribution is currently confined to contractors. Clay sewer pipe manufacturers licensed by B. F. Goodrich are producing pipe with Koroseal joints in diameters of 4, 6, 8, and 12 in.; plans are underway to make pipe up to 36 inches.

Another Polyethylene

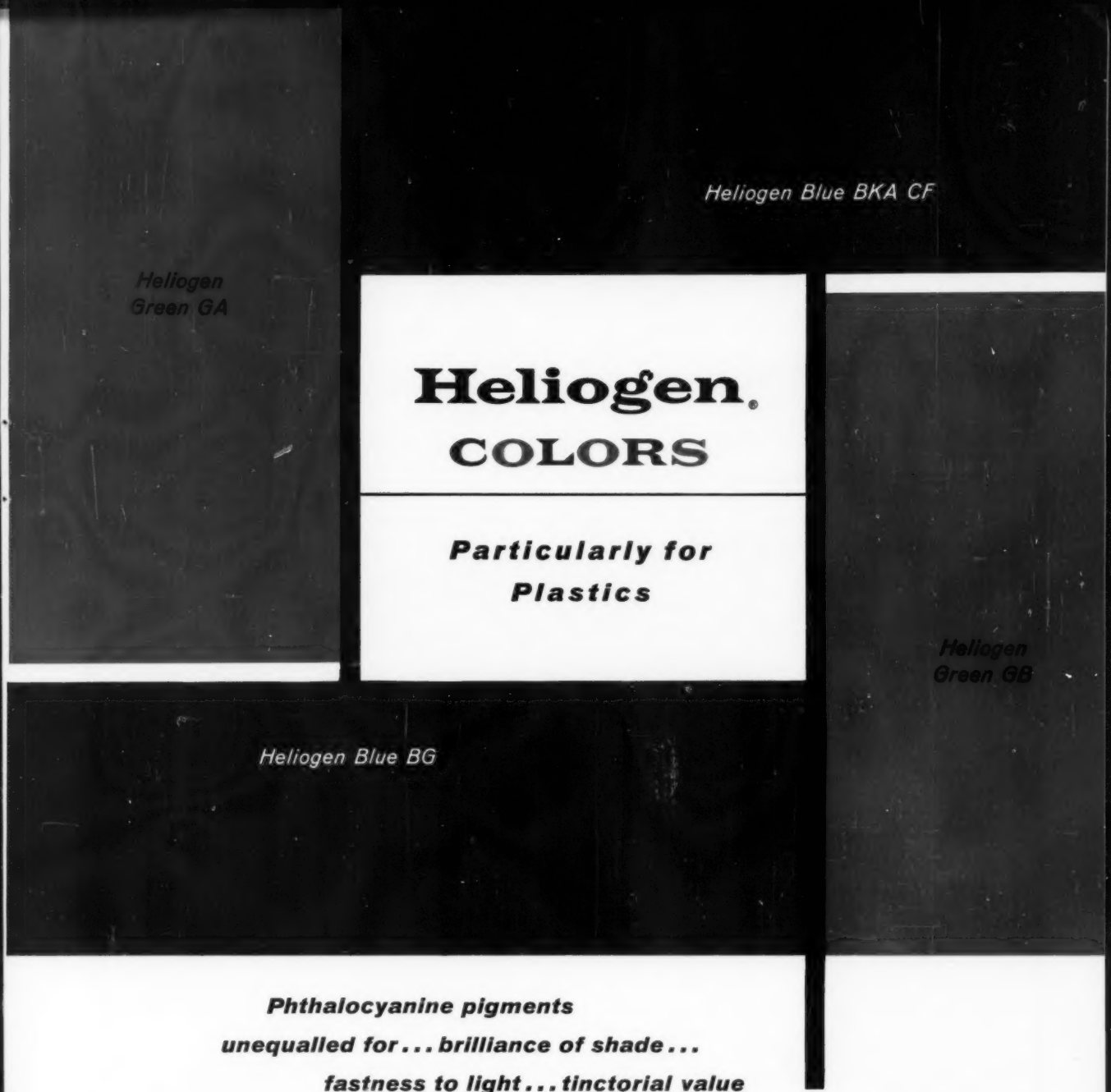
PRODUCTION of a new high-density, boilable polyethylene will be started soon by Monsanto Chemical Co. at Texas City, Texas. The facility has been called an interim plant, the normal translation of which would be a semi-works plant; it is assumed in the trade that the material produced will be a brand-new polyethylene.

Apparently, Monsanto will now have three different kinds of polyethylene. Its plant for production of traditional or so-called high-pressure polyethylene is claimed to be in operation. Some time ago, the company announced that it has obtained a license to produce the Ziegler type of polyethylene, which has been generally termed low-pressure polyethylene. The third type, developed in a small pilot plant at the company's Chemical Research Dept. in Dayton, Ohio, is the result of many years of research.

Wide Teflon Tape

AVAILABILITY of Kelon-T (Teflon) tape in widths up to 24 in. for aircraft, hydraulic, and general industrial use has been announced by W. S. Shamban & Co., 11617 W. Jefferson Blvd., Culver City, Calif. The new tape is made in thicknesses from 0.005 to 0.125 inch.

With uniform dielectric constant and power factor over an extremely wide frequency range and at temperatures of —300 to 300° F., Kelon-T tape is claimed to be especially effective in industries requiring equipment with non-sticky surfaces. Electrical uses include motor-slot liner, cable wrapper, ca-



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Heliogen Colors are supplied in powder or presscake form—according to the user's requirements. Compounders of plastics—and particularly the Vinyl plastics—standardize on these colors for their ease of handling, their chemical stability and their brilliance. (This page was printed with inks made from the Heliogen Colors as indicated.)

The powders are noted for ease of grinding. The corresponding presscakes flush readily into the plasticizers normally used. All are non-crystallizing in the presence of aromatic solvents—with the exception of Heliogen Blue BKA Powder CF. All are relatively heat stable—particularly the Heliogen Blue BG Powder which is outstanding in this respect.

To help you meet your particular requirements as to qualities, method and ease of application, let us send you our free new specifications booklet on Heliogen Colors—or call on the services of our Technical Department. Please address your inquiry to Department 29.

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VINYL PLASTISOLS

MICCROSOL, a product of Michigan Chrome & Chemical Company, is a true vinyl plastisol which can be readily adapted, through special formulation, to meet the strictest requirements for: dipping, casting, slush molding, etc.

We will be pleased to submit a sample of one of our many proven coatings, or engineer a vinyl plastisol for your product.

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Producing PLASTIC PARTS for Industry since 1876

Put Auburn's engineering "know-how" and production facilities to work producing plastic parts for your product! Backed by 78 years experience!

Our Diversified Facilities Include:

- **Compression, transfer and high-speed plunger presses up to 600 tons capacity.**
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- **Finer-textured, more uniform styrene sheets now available up to 51" wide . . . up to ¼" thick. Any color.**
- **Tool and die shop • Engineering services.**

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4 POST "C" PRESS

Many Mayflower "exclusives" are built into these presses, noted for their precision and high level production. Bed plates are from 16"x24" up to 48"x96". Adaptable to a great variety of sealing operations on the lightest of plastic sheeting.

We welcome the opportunity to consult with fabricators faced with difficult sealing problems.

Mayflower ELECTRONIC DEVICES Inc.

Only Manufacturer of both Bar and Rotary Electronic Heat Sealers

UNion 3-7100

6014 Hudson Blvd. **West New York, N. J.**

pacitor dielectric, coil wrapping, and gasket shielding for corrosive chemicals.

Because of its self-lubricating, non-sticky properties, the tape is used in the printing industry to cover platens on printing presses. The service life of Kelon-T tape is also said to exceed that of conventional gasket materials in equipment handling highly corrosive chemicals.

Equipment for Coordinated Vacuum Forming

EQUIPMENT that will provide a coordinated production line from extruder to finished product in vacuum forming operations will soon be offered to the trade by Formvac Corp. which has recently become a division of Welding Engineers, Inc., Norristown, Pa.

Formvac was formerly a subsidiary of Hydro Chemie, Ltd., Switzerland. Officers of Formvac are the same as those who preside over Welding Engineers, except that Millard Demarest, well known in the plastics industry, has been appointed sales manager of the new division.

The division has also made special arrangements with Robbins Plastic Machinery Corp., Elkhart, Ind., for dies, take-off equipment, and laminating and cutting tools to be incorporated in a Formvac vacuum forming system. Included in this system will be loading and unloading equipment for sheet which Welding Engineers' technicians are now developing, as well as Hydro Chemie equipment for testing the sheet.

Welding Engineers has also announced that it now has ready for the trade a new single worm extruder in 2, 2.8, 3.5, 4.5, 6, and 8 in. sizes. Even larger ones can be supplied if there is a demand for them. Company executives believe that this extruder is the answer to the demand for a large, rugged, heavy duty, single-screw machine that can be successfully used for production of rigid vinyl pipe and other plastics products that require pin point control and a maximum of working.

Another Paraplex

SEVERAL years ago, Rohm & Haas Co., Philadelphia 5, Pa., introduced Paraplex G-60 plasticizer which became well known not only as a plasticizer but also as an effective stabilizing material for vinyl-type polymers. Since that time the company has been attempting to improve certain properties of this material, particularly compatibility.

This program has led to the development of Paraplex G-61, with the following advantages: better compatibility; improved ultra-violet durability; slightly better gasoline and oil resistance; and greater resistance to migration.

Polyurethane in Canada

PRODUCTION of Collo Allfoam, based on polyurethane, will soon be started by Robinson Collo Canada, Ltd., Woodbridge, Ont., jointly owned by Robinson Cotton Mills, Ltd. and American Collo Corp. Robinson Collo will operate under a license granted by Mobay Chemical Co., St. Louis, Mo.

It is anticipated that the Woodbridge plant will be in full operation by the end of September 1955, and that it will then be in a position to supply polyurethane foam in a variety of densities, pore structures, and in various colors in blocks, sheets, and special shapes prepared for a large variety of specific applications in industry.

Plastics in Puerto Rico

A STUDY of the growth of plastics in Puerto Rico has just been completed by the Economic Development Administration and the resulting report indicates that the number of mainland-affiliated plastics plants has multiplied six-fold in four years--from four in 1950 to 24 in 1954. Value of shipments to the continental United States passed the $5 million mark during 1954.

At present the manufacturing line-up includes: six independent molding operations, one laminating plant, and 13 assemblers and fabricators. In addition, four companies maintain separate integrated plastics departments. They are: Frawley Corp. (Paper-Mate pens); National Moldite Co. (molded coil forms); Weller Electric Mfg. Co. (electric soldering irons); and Remington Rand (electric shaver housings).

Materials locally available have grown with the industry, the report discloses. The Dow Chemical Co., through its local agent, maintains a constant inventory of about 1 million lb. of styrene resins and other plastics materials which are supplied to local producers at mainland prices. Both Monsanto Chemical Co. and Koppers Co., Inc. have similar installations.

Most of Puerto Rico's new plastics companies operate income-tax free during their first 10 years. Generally, any manufactured or fabricated plastics product is eligible for local income tax exemption as are assembly operations in which the percentage of value added is 20 to 25% or more. There is no Federal income tax in Puerto Rico since the island has no voting representation in the United States Congress.

Further information on Puerto Rico's industrial development program with special reference to plastics manufacture may be obtained from the Office of Economic Research, Commonwealth of Puerto Rico, 579 Fifth Ave., New York 17, N. Y.

Foamed in Place

TWO new fire-retardant mastics and catalytic coatings of the isocyanate and epoxy type have been announced by Surface Chemicals, Inc., Div. of The McKay Co., McKees Rocks, Pa. The foaming resin, called Isothane, can be foamed at the point of use. Even voids and cavities normally inaccessible can be filled with this material.

Other products of Surface Chemicals include epoxy films, adhesives, and fillers of all types.

Flexographic Printing

INFORMATION on flexographic printing, which is of ever-increasing importance to plastics film converters, has been incorporated in a data sheet and a special report recently released by Bensing Bros. & Deeney, 3301 Hunting Park Ave., Philadelphia 29, Pa.

The three-page data sheet covers recommended usage of 400 Series Flexographic Ink, a multi-purpose universal ink designed for printing on almost all types of cellophane, polyethylene, foil, glassine, and pa-

THE PLASTISCOPE

pers. In addition to its versatility, 400 Series Ink is said to give clean and glossy results, and to retain its flexibility and adhesion under severe temperature extremes. It is self-soluble to prevent ink buildup on plates and rollers.

The special report covers the subject of multicolor by overprinting with flexographic inks, and is part of a packet which also contains samples of film and paper printed by the overprinting technique.

Paint for Plastics

PROBLEMS involved in the color-coating of plastics and an explanation of why and when such coatings may be advantageously used with such molded materials as polystyrene and acetate is the subject of a plastics coating color book and kit by Thompson & Co., Oakmont, Pa.

Water Soluble Polymers

ANNOUNCEMENT has been made by Nopco Chemical Co., Harrison, N. J., that the firm is interested in developing new markets for its line of water soluble polymers and resin emulsions produced by polymerization and co-polymerization reaction.

According to Dr. Edwin A. Robinson, vice president in charge of Nopco's industrial product development program, a new polymerization unit has been installed at the company's Cedartown, Ga., plant to provide facilities for large-scale production of these products. He states that the polymers and resin emulsions are already finding widespread use as textile warp sizes, adhesive components, and paper coating binders.

Monsanto's New Vinyls

SOME months ago, Monsanto Chemical Co. announced an expansion of production facilities for the manufacture of vinyl chloride resins. Now the company states that it will make three new vinyl compounds for wire coating and for other types of vinyl extrusion.

The wire coating compounds are designated as Opalon 1038, 72254, and 72217. Opalon 1038 is for use in the manufacture of large size building wire and UF-NMC cable, and is suggested for cable jacketing. Opalon 72254 is a general-purpose, flame-retardant jacketing compound. Opalon 72217 is compounded specifically for switchboard cable and inside telephone wire jacketing.

Another material, called Opalon 75219, is a vinyl chloride extrusion compound with non-migratory plasticizer and a specially selected fungicide. It was developed particularly for the extrusion or molding of vinyl parts which come into contact with styrene. Styrene will not leach out from the plasticizer nor cause the component to soften or deteriorate. Opalon 75219 is suggested for such applications as pastel colored door gaskets for refrigerators with styrene liners.

Clean Stamp Pad

DEVELOPMENT of a stamp pad which never needs re-inking has been announced by Target Products Corp., 59 Alpine St., Newark 5, N. J.

Combining the chemistry of ink and plastics, the pad consists of a cloth covering over a gelatin-like ink which is a hydrosol compounded of vinyl resin, plasticizer, and stabilizer. Because there is no absorbent material in the Never-Ink stamp pad, stamps never clog or get dirty, insuring clear, sharp prints. Never-Ink stamp pads are guaranteed by the company for two years.

Quartet of Plasticizers

FOUR new plasticizers for modifying vinyl resins, now commercially available from B. F. Goodrich Chemical Co., Cleveland, Ohio, include two each of the phthalate and adipate types.

The two phthalate-type plasticizers are marketed as GP-265 and GP-266. The use of GP-265 provides lower initial viscosity and improved viscosity stability in vinyl plastisol compounds. GP-266 has extremely low volatility and excellent electrical properties, making it advantageous for high-temperature wire and cable applications.

The new adipate plasticizers, called GP-235 and GP-236, are noted especially for their low-temperature flexibility and for their low volatility, longer life, and good electrical qualities. Combinations of the adipate-and phthalate-type plasticizers in compounding can be developed to fit a broad range of temperature requirements.

Better Surface for Laminates

ELIMINATION of traditional telltale mat prints on finished reinforced plastics products is claimed for a new operational procedure, called Lunn Finish #107, which does away with buffing, sanding, and painting in press molding manufacture. Research and development work on the process was conducted by Lunn Laminates, Inc., Huntington Station, N. Y.

According to Harry T. Douglas, who directed the research, the best way to eliminate the mat prints is to hide them, and the one material found to be most satisfactory for the purpose, says Mr. Douglas, is a non-woven cotton fabric manufactured by Kendall Mills Co. and called Webril R.

In the course of the experimental work, it was demonstrated that Webril Grade R-2801, uncalendered, gave superior results when proper manufacturing methods were observed, according to Mr. Douglas, who further disclosed that other fiber-hiding chemical-resistant surfaces have been developed from non-woven synthetic fiber fabrics.

Phenolic-Surfaced Plywood

SURFACED with phenolic resin and cellulose fiber, a new weatherproof plywood panel, is a versatile medium for both residential and commercial construction, and offers important cost saving potentials.

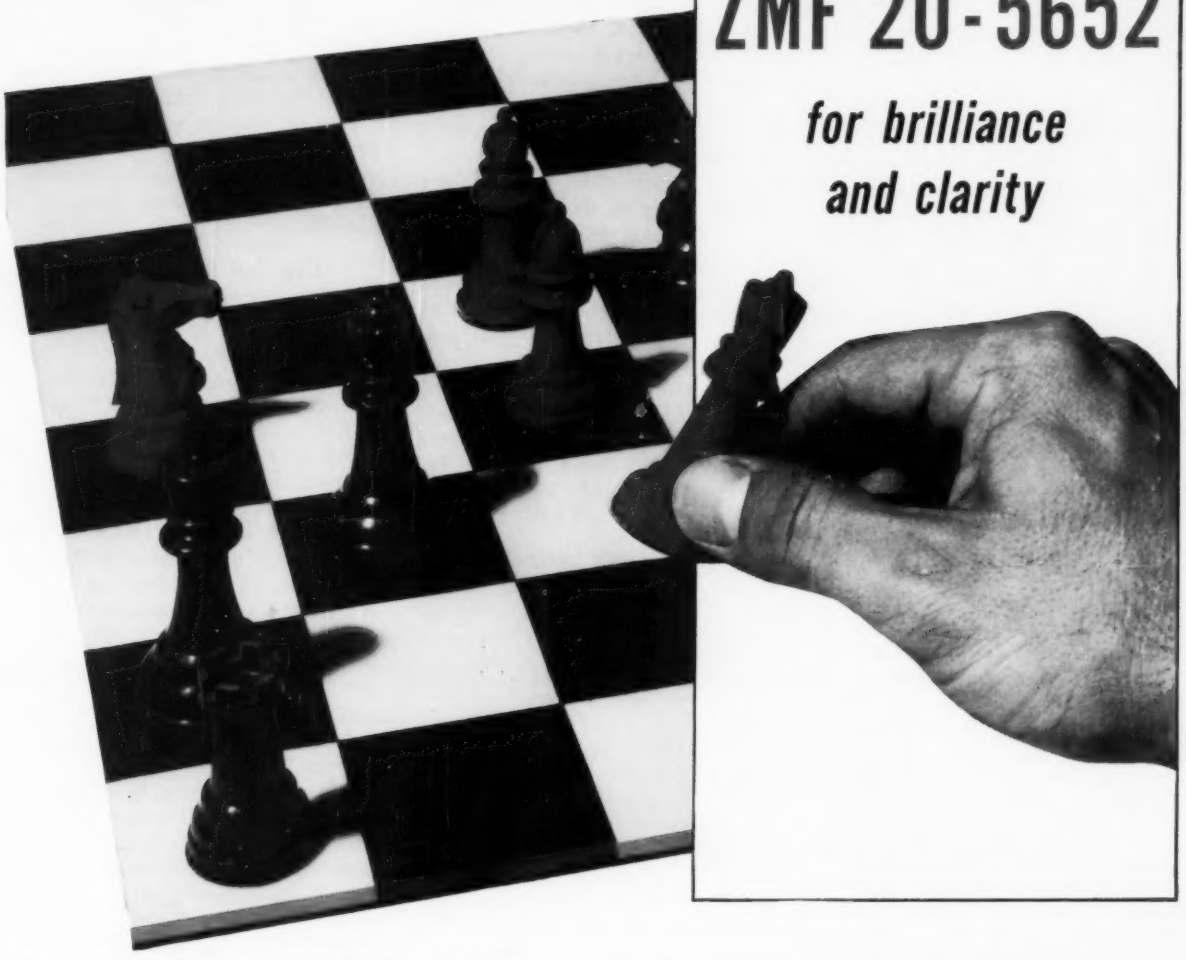
The product, called Duraply, is manufactured by United States Plywood Corp., 55 W. 44th St., New York 36, N. Y. It is made of exterior grade fir plywood, to one or both sides of which is permanently bonded under heat and pressure a smooth overlay sheet of Crezon, the resin-treated fiber. This protection prevents checking, swelling, and grain raising and makes the panel more moisture resistant.

Of a light buff color, the material may be used for interior as well as exterior applications. It is completely free of delamination and its hard,

Winning Move! Specify

Red Lake C Toner ZMF 20-5652

for brilliance and clarity



High strength, brightness, transparency and good working properties place Cyanamid's Red Lake C Toner in top demand for use in a wide variety of plastics media.

Good dispersion and stability to heat and light, coupled with freedom from crocking, efflorescence and color migration, make 20-5652 the logical choice of the plastics formulators.

In combination with titanium dioxide, it matches the Bureau of Standards PSP No. 70 color for polystyrene plastics.

Your Cyanamid Pigments representative will gladly supply you with full information and samples of this versatile pigment.

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PIGMENTS DIVISION
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
BRANCH OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

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smooth surface resists wear and abrasion. Duraply is unaffected by normal exposure to rain, sun, freezing temperatures, and other elements.

Uses of Duraply include siding, panelling for kitchens, bathrooms, laundries, closets, wall units, cabinet work, outdoor signs, and furniture. The material has all of the wood-working characteristics of regular plywood. It is easily fabricated with conventional wood-working tools. The panels are light in weight and the overlay sheet is reported to prevent edge splintering.

Hoover Heads M.C.A.

AT THE 83rd annual meeting of Manufacturing Chemists' Association, Inc., Washington, D. C., J. R. Hoover, president of B. F. Goodrich Chemical Co., was elected chairman of the board of directors. He succeeds Fred J. Emmerich, president of Allied Chemical & Dye Corp.

Well known in the plastics industry, Mr. Hoover was a director of Plastics Materials Manufacturers' Association before it was merged with M.C.A. He is also a former president of The Society of the Plastics Industry, Inc.

Mr. Hoover was born at Little Falls, Minn., in 1903. He joined B. F. Goodrich Co. in 1925 after graduating from Harvard College; in 1945 Mr. Hoover was named vice president of B. F. Goodrich Chemical Co. and became president in 1951.

Election of Mr. Hoover as chairman of M.C.A. marks the first time that a member of the rubber industry has become head of this large chemical group.

Non-Woven Backing

INTRODUCTION of Lantuck-NR, new non-woven backing fabric which will give automobile and furniture upholsterers greater flexibility in tailoring and fitting, has been announced by the Lantuck Div., Wellington Sears Co., 65 Worth St., New York, N. Y., selling agents for West Point Mfg. Co., West Point, Ga.

The material is claimed to stretch in all directions under stress and to spring back to its original shape when conditions return to normal. Made of random nylon and rayon fibers bonded together with a special agent which gives greater elasticity, Lantuck-NR was specifically designed as a reinforcement for vinyl films and coatings.

The company states that, as a result of years of development, the fabric has exceptionally high tear strength; it has equal tensile strength, tear, and stretch characteristics in all directions. The material's smooth surface is a good base for embossing, even with deep-grained patterns on very light vinyl coatings. Already in use in automotive and furniture upholstery, Lantuck-NR also shows promise for other uses, such as for luggage, footwear, and handbags.

Epoxy-Paper Laminate

EPOXY-PAPER laminate called Epinate, from 15 mils to ½ in. thick in 18- by 18-in. sheets is now available from American Printed Circuits Co., Inc., Forrest St., Metuchen, N. J.

This material is a high-pressure paper laminate with an epoxy binder. The paperboard can be copper clad on one or both sides in 1-, 2-, and 3-mil electrolytic copper. It is reported to possess greater mechanical strength than presently available paper laminates of electrical grades, very low water absorption, low thermal expansion, and high arc resistance. The arc resistance of an 0.1247 in. thick sheet is 93 seconds. It also has a high 60-cycle power factor and extreme chemical resistance. Its water absorption after 24 hr. immersion is 0.27 percent. The heat distortion temperature of the laminate is reported to be higher than 400° F.

The price of $3.00 per 18- by 18-in. sheet of 1/16 in. thickness is about half way between XXX paper-phenolic laminates and epoxy impregnated glass cloth. Its impact strength is not as great as epoxy-glass laminates, but plenty good enough for many uses.

Epoxy glass cloth. also made by this concern, is especially suited for high frequency work, guided missiles, computers, and meters for testing equipment.

Another use of the material is in printed circuits, of which the company makes their own. They are flush type on epoxy paper board and glass cloth. The laminate and circuit are made in one operation by an electroforming process, as distinguished from the etching process for making printed circuits.

Further work is being carried out in American Circuits' plant on development of epoxy laminates using Dacron and Orlon as the reinforcing material.

New York S.P.E. Meeting

ANNOUNCEMENT has been made that the New York Section of the Society of Plastics Engineers, Inc. will hold its September meeting in two sections, the topic to be "Plastics in the Building Industry."

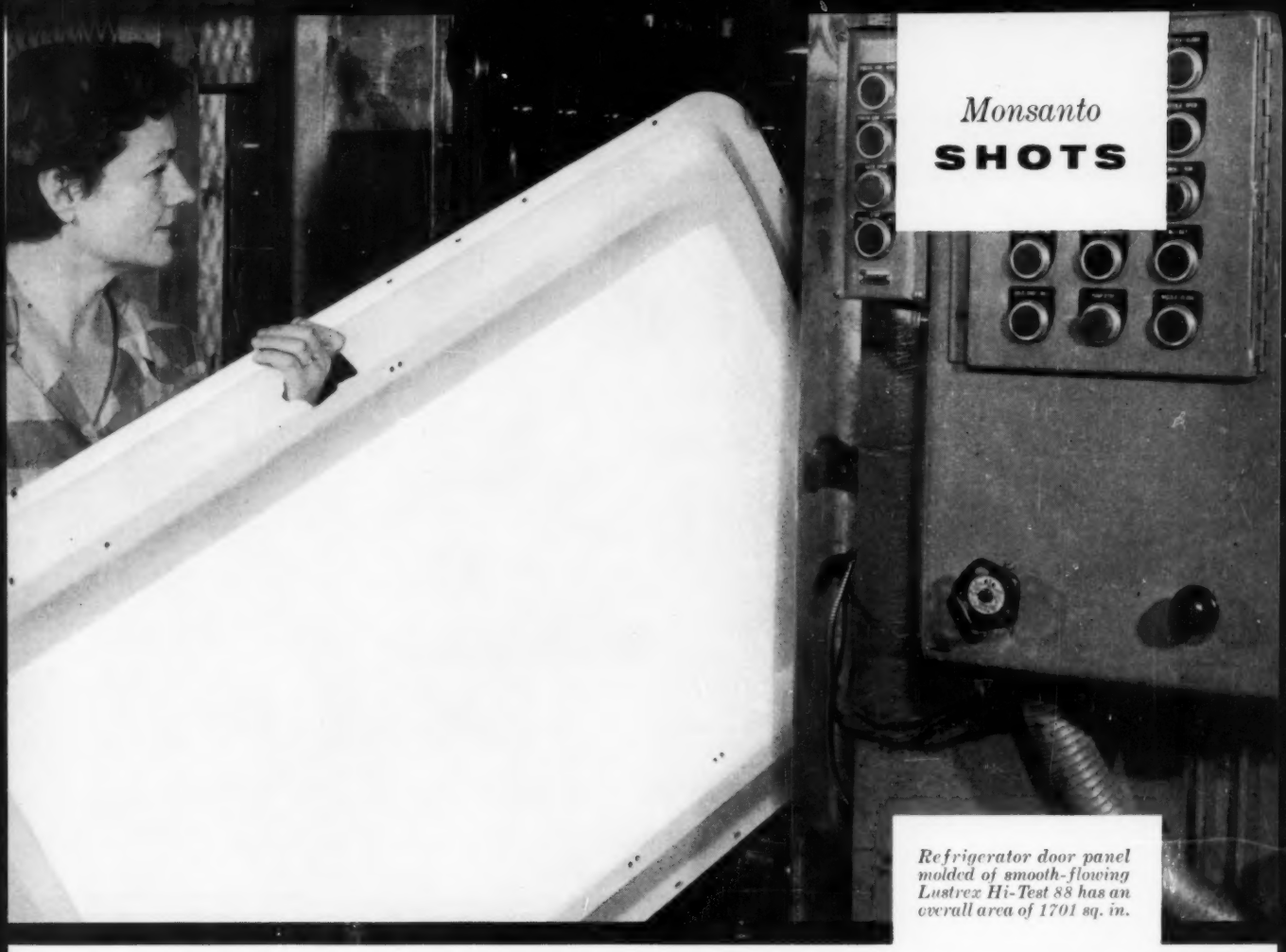
The first of the two meetings, to be held on September 21, will be opened by Charles Telchin, a New York City architect. Main theme will be "Specific Decorative Uses of Plastics in the Building Industry." A spokesman from Bakelite Co. will discuss plastic flooring, wall covering, and decorative laminates. A speaker from Monsanto Chemical Co. will discuss the subject of "The Future of Plastics in the Building Industries."

The second meeting, to be held on September 28, will cover "Specific Structural Uses of Plastics in the Building Industry." Harry Friedman, Russell Reinforced Plastics Co., will discuss reinforced plastic gutters and leaders; Foster Monaco, Mastercraft Plastics, Inc., will discuss reinforced plastic wall panels; and Rohm & Haas Co. will furnish a speaker to discuss the subject of light transmission paneling with reinforced plastics and with acrylics.

No Microbes

PRODUCTION of plastic film treated with a new anti-microbial compound, called Sub-Du, has been announced jointly by Imperial Chemical & Plastic Corp., 16 W. 40th St., New York, N. Y., and Wilcris Chemical Corp., 342 Madison Ave., New York, N. Y. The new treatment is being offered to the plastics, textile, apparel, and home furnishing industries.

Wilcris points out that laboratory



Monsanto
SHOTS

Refrigerator door panel molded of smooth-flowing Lustrex Hi-Test 88 has an overall area of 1701 sq. in.

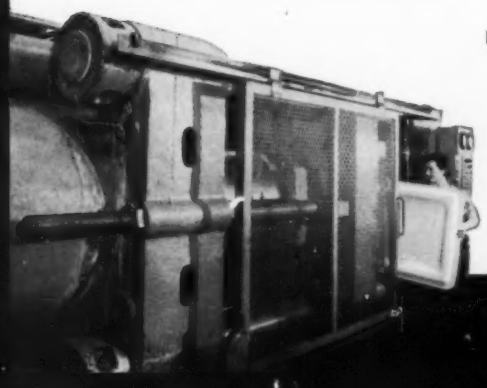
Cycle down 15 seconds, production up to 1000 a day . . . with **LUSTREX HI-TEST 88**

These facts about molding refrigerator door panels on a 300-oz. machine are reported by George Kovacs, President of General Machine & Tool Works, Inc., Walled Lake, Michigan:

A 1701 sq. in. mold is used, with Monsanto's Lustrex Hi-Test 88 flowing in at over 30,000 lbs. per sq. in. This means 36,000 tons pressure applied within the mold. By using Monsanto's high impact styrene on this job, the problems that could be caused by a mold restriction have been eliminated.

Because of outstanding flow characteristics, Lustrex Hi-Test 88 styrene has cut the cycle time to 80 seconds—about 15 seconds less than before. Production up to 1,000 units a day has been achieved—with excellent finished luster.

This is typical of the improved results molders are experiencing with Lustrex Hi-Test 88. Why don't *you* try this high impact styrene on your next job. Write Monsanto Chemical Company, Plastics Division, Dept. MP8, Springfield 2, Mass.



For superior toughness, specify HI-TEST 88 LUSTREX Styrene Plastic

MONSANTO

tests show that vinyl film treated with Sub-Du is not only antimicrobial, but that the original color, texture, or hand are not impaired. The treatment acts as an efficient deodorant by striking at the source of unpleasant odors—bacterial activity. In addition, Sub-Du-treated vinyl film prevents the formation and action of mildew. Manufacturers of hospital and baby products are reported to be experimenting with Sub-Du-treated film.

Light-Stable Polystyrene Diffusers

IMPROVEMENT of the light stability of extruded plastic diffusers for fluorescent fixtures has been announced by Sheffield Plastics, Inc., Sheffield, Mass. Accelerated aging tests indicate that the diffusers will resist discoloration as long as seven years in normal use—equivalent to the best performance of diffusers made from top-quality polystyrene materials now available.

The light stability of Sheffield diffusers is determined through the use of a mercury arc light test, devised by company engineers, which closely parallels conditions encountered in actual use. According to J. B. Orr, manager of Technical Service, the test makes it possible to eliminate batches of raw materials which exhibit excessive discoloration.

H-P-M Changes

A COMPLETE review of company policies and plans by the board of directors has been announced by G. B. Robinson, board chairman of The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

The first decision was that the company will continue as an independent organization. H-P-M has been mentioned repeatedly in reports of consolidation negotiations in recent months. It was also decided to select key personnel to carry out new decisions reached in the policy review.

The five executives selected for this program are: William H. Bennett, vice president in charge of sales; J. W. Arnold, vice president in charge of manufacturing; William N. Woodward, secretary-treasurer; Robert J. Lindsey, director of engineering; and Glen R. Pittman, sales manager, Hydraulic Power Div.

Polymeric Plasticizer

NOW marketed by Morton-Withers Chemical Co., Greensboro, N. C., is a new, high-molecular-weight polymeric plasticizer for vinyl resins called Morflex P-50.

The product is a water-white liquid which is claimed to combine ease of handling; ready compatibility; good color and aging; extremely low extraction characteristics in water, soapy water, oil, and air; and unusually high electrical qualities.

Morflex P-50 is now available in volume, priced at 68¢ a lb. in tank trucks and 70¢ a lb. in drum carloads, all F.O.B. Greensboro, N. C.

Wash Day Without Static

TRADENAMED Plasti-Kleen, a liquid, anti-static detergent for washing plastics articles has been developed by Spix Products Co., 119 Dahlem St., Pittsburgh 6, Pa.

The company states that initial marketing efforts are being directed to building maintenance people, promoting the detergent for washing illuminating fixtures, displays, and other plastics architectural features. In washing lighting fixtures, workmen usually allow plastics parts to air-dry for several hours to avoid static build-up caused by rubbing. Washing with Plasti-Kleen kills static charges on plastics surfaces and permits immediate rub-drying and re-installation in one operation. Plastics remain clean for a considerably longer period than when washed with ordinary detergents. A bath of 2 oz. of Plasti-Kleen per gallon of water is recommended.

Thiophene

COMMERCIAL quantities of thiophene, a heterocyclic sulfur compound, are now being supplied by Sharples Chemicals, Inc., 1000 Widener Bldg., Philadelphia 7, Pa., a subsidiary of Pennsylvania Salt Mfg. Co. The company states that the compound is expected soon to be widely used in plastics, rubber, resins, as well as in agricultural and photographic chemicals.

In reactivity, thiophene is similar in many respects to phenol, benzene, and certain unsaturated hydrocarbons. It is readily nitrated, halogenated, alkylated, metalated, acylated, aminated, and undergoes condensations with formaldehyde and maleic anhydride.

Commercial production of thiophene was recently brought on stream in the new plant facilities operated by Index Chemical Co., Houston, Texas, a subsidiary acquired by Pennsalt in January 1955.

Samples and technical bulletin on thiophene are available from Sharples Chemicals, Inc.

Scavenger

A NEW organic stabilizer which is claimed to be outstanding for its heat-and light-stabilizing properties has been announced by Advance Solvents & Chemical Corp., 245 Fifth Ave., New York 16, N. Y. Tradenamed Advastab XE-82, the stabilizer is an effective scavenger for HCl and, as such, is a most powerful auxiliary stabilizer for vinyls.

Prices of Advastab XE-82 are 85¢ a lb. in 10-drum lots, and 95¢ a lb. in less than drum quantities.

Polyester Prices

PRICE adjustments on polyester Polylite resins, based principally on styrene content, have been announced by Reichhold Chemicals, Inc., 525 No. Broadway, White Plains, N. Y.

Polylite resins containing 40% styrene have been reduced by 2¢ a lb. and those with 33% styrene, 1 cent. The reduction applies to any quantity of Polylite delivered in drums.

Mylar Electrical Tape

NOW available from Permacel Tape Corp., New Brunswick, N. J., is a new, electrical heat-curing tape made from clear 1-mil polyester Mylar film.

Designated as Permacel 253, the Mylar tape is the latest addition to the company's line of 2-in-1 tapes, which in the uncured state are said to have excellent pressure-sensitive characteristics and which can be heat-cured to firm the adhesive and make it solvent resistant.

The rubber-base adhesive is free of corrosive agents and contains no

Symphony in Black...

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Noted for their uniformly high quality for over 25 years, Witco-Continental channel and furnace blacks are produced in 5 modern plants under strictest controls to assure you consistent, dependable performance.

Witcoblak® No. 11—low color channel
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WITCO OFFERS A COMPLETE LINE OF:

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sulfur. In addition, it has a high tensile strength, affording optimum performance in wire-holding applications. The tape is claimed to have low moisture vapor permeability and to withstand temperatures up to 302° F.

Vinyl for Wire

ANNOUNCEMENT has been made by Naugatuck Chemical Div., U. S. Rubber Co., Rockefeller Center, New York 20, N. Y., that its Marvinol VR-22, a vinyl resin for extrusion from dry-blend or granular compounds has been approved by Underwriters' Laboratories, Inc. for electrical applications.

According to a statement by Underwriters' Laboratories, Marvinol VR-22 can be used interchangeably in any approved wire insulation formulations based on straight polyvinyl chloride. The resin is of medium-high molecular weight, has good blending characteristics, and permits shorter Banbury cycles. In dry-blend extrusions, Marvinol VR-22 has good uniformity and extrudes at high rates of speed.

Wrap up in Color

DEVELOPMENT of a new filament-reinforced colored paper tape which adheres firmly to flexible plastic surfaces but can be removed without leaving residue or discoloration, has been announced by Behr-Manning Div., Norton Co., Troy, N. Y.

The product, called No. 252 Behr-Cat Tape, is available in a variety of colors in 60-yd. rolls from ¼ to 1 in. wide. List prices per roll range from $1.32 to $3.30. The pressure-sensitive tape can be furnished in widths other than standard upon special order.

Plastics in Furniture

PLASTICS products for the furniture industry, ranging from fabrics to cabinets, will be exhibited to furniture manufacturers at the Furniture Fair to be held at the Conrad Hilton Hotel, Chicago, Ill., from August 28 to September 1.

The Fair will be held in conjunction with the 27th annual convention of the National Association of Furniture Manufacturers. Some 4000 furniture manufacturers — nonmembers as well as members of N.A.F.M.—have been invited to attend. Among firms who will exhibit at the show are General Electric Co., Coshocton, Ohio; Masland Duraleather Co., Philadelphia, Pa.; Textileather Div., The General Tire & Rubber Co., Toledo, Ohio; U. S. Rubber Co., Mishawaka, Ind.; Mack Molding Co., Wayne, N.J.; and Farley & Loetscher Mfg. Co., Plastics Div., Dubuque, Ia.

Won't Stick

DEVELOPMENT of Mold-Wiz, a new mold-release agent, has been announced by Axel Plastics Research Laboratories, 287 Broadway, New York, N. Y. The product is claimed to be more versatile than traditional release agents. It coats all types of molds, forming a hard, mirror-like finish that resists the tendency of rubber, metal, and plastics to adhere to the mold.

Mold-Wiz is reported to be noncorrosive, non-toxic, and non-explosive and does not interfere with subsequent plating or painting of molded parts.

The product is available in 1-gal., 5-gal., and 55-gal. steel containers at $6.00 a gallon F.O.B. New York, N. Y.

Ultra-Violet Light Absorber

A NEW type of chemical that prevents ultra-violet light-caused darkening or color changes and at the same time removes static electricity on all types of plastics has been developed by Merix Chemical Co., 1021 E. 55th St., Chicago 15, Ill.

The ultra-violet light absorbing chemical, called Stabilite, is claimed to be so powerful that a film of 0.001 in. will filter out 99.8% of incident ultra-violet light at wavelength 400 and 100% at all wavelengths below 390 mμ, according to Eric O. Sonneman, general manager of the company.

Fully transparent to visible light, Stabilite applied to plastics by the dip, spray, or wipe method, is tough enough to prolong the useful life of plastics. A layer as minute as 0.000006 in. will still filter out 43% at wavelength 310.

Cost is small. In large industrial volumes, Stabilite is offered as low as 35½¢ per pound. Since 1 gal. (8 lb.) treats an average 4000 sq. ft. of plastics, it costs only 0.07¢ to treat 1 sq. foot. Even in single sample gallons, cost is only $1.75 per pound.

Gravure Printing on Plastics

FORMATION of a wholly-owned subsidiary, Ullman Gravure, Inc., has been announced by The Ullman Co., 319 McKibbin St., Brooklyn 6, N. Y. The corporation was organized to actively promote the sale of photo-gelatin displays to the trade.

Special emphasis will be on Ullman Transplastix, a method of printing in photo-gelatin on sheet-fed gravure, on any type of plastic in full process color.

The new company's equipment consists of two 5-color rotogravure presses with 32- and 20-in. webs, five 40- by 54-in. sheet-fed gravure presses, and four 40- by 60-in. photo-gelatin presses.

Whale Boats Like a Feather

IT IS reported that the United States Navy is building some 100 whale boats from fibrous-glass reinforced polyester resin supplied by Reichhold Chemicals, Inc., 525 No. Broadway, White Plains, N. Y. The 26-ft. craft, auxiliary equipment on almost all Navy ships, are 500 lb. lighter than comparable steel boats.

Reichhold states that maintenance cost will be negligible. Calking will be unnecessary because the hulls are leak- and rotproof, and the lustrous, natural finish requires no paint. The hulls are highly resistant to impact. Should damage occur, however, patching will be relatively easy.

The original test model was constructed by the Norfolk Naval Shipyard in Portsmouth, Va.

Ethylene Glycol Diacetate

DEVELOPMENT of a new process by Celanese Corp. of America's Chemical Div. has made possible economical production of ethylene glycol diacetate, according to a statement by R. W. KixMiller, vice president of the division.

Volume production of the new

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A look at the many Styron® products on the market shows the beauty in design, wide color range and varying physical properties possible with Dow's different Styron formulations. There may be times, however, when you want to add further functional and decorative effects to Styron. Coatings and finishes can be the perfect answer if they're selected and used properly.

Dow has studied and evaluated many techniques and methods for the coating of Styron. The very *business* of Plastiatrics is to provide a continuous study, analysis and treatment of all phases of plastics and their application so that successful results can be predicted.

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First, of course, you consider the results you want. Then you apply the coating that will give you that result. It is important, however, to pay careful attention to application technique. For example, lacquers are used for the striking back painting method which gives depth and gem-like appearance to escutcheons. But to be just right, the molded part should be checked for residual stress and the effect of lacquer solvent on crazing. There must be enough solvent attack to insure lasting adhesion but not enough to weaken the molding. It is important to know whether lubricants are used in the material or molding process and what effect they may have on surface adhesion. Surface treatment and application techniques can be worked out to meet specific needs. For instance, metallizing can be accomplished in any one of five different ways to provide additional physical properties or improved appearance.

An example of metallizing of Styron.

For a specialized interior finish to resemble suede, felt or mohair, a flocking process may be used. Metallizing, flocking and lacquering require many of the same basic considerations when it comes to proper application techniques. Printing and labeling to add printed words, identification, directions, etc., also pose application problems similar to lacquering, although not as critical in nature. Of course, every different type of application technique, coating, or finish requires special attention to its own problems.

How Dow's Plastiatrics Studies Can Help You

Dow studies can be of service to you because they include extensive information not only on different types of coatings and finishes but on proper application techniques, surface cleaners, drying procedures and other data. This information can help you produce results while avoiding a long trial-and-error approach that often means a costly expenditure in both time and money.

Free Bulletin Offered

For more complete information on this subject, send for your free copy of Dow's Technical Service bulletin entitled "Coatings and Finishes for Styron." Write to Plastics Sales Department PL 455R, THE DOW CHEMICAL COMPANY, Midland, Michigan.

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- Styron 700 . . . for high heat resistance.
- Styron 637 . . . for improved light stability.

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chemical has been started at the Bishop, Texas, plant and a favorable price structure has been established for ethylene glycol diacetate for use as a solvent in cellulose ester lacquers, fluorescent-type paints, and printing inks; as a fugitive plasticizer in baked vinyl coatings; and as a perfume fixative.

Polyesters for Polyurethane

TWO experimental polyesters suitable for use in making polyurethane foams are being offered to selected manufacturers for evaluation, according to an announcement by Reichhold Chemicals, Inc.

Polyurethane is made by mixing a polyester with toluene diisocyanate and various additives. One Reichhold polyester is used to make flexible foams, the other to make rigid foams. Density of the foams can be varied.

Manufacturers' inquiries should be directed to D. G. Patterson, sales manager and technical director, Polyester Resin Div., Reichhold Chemicals, Inc., 525 No. Broadway, White Plains, N. Y.

Heat-Resistant Vinyl Sleeving

AVAILABILITY of a new vinyl insulation sleeving, called Resinite Super-Heat 125, has been announced by Resin Industries, Santa Barbara, Calif. The material is intended for use under severe conditions and is recommended by the company for use in connection with oil transformers, motors, and appliances which require prolonged resistance to heat, oil, and abrasion.

Characteristics of the material include superior heat aging qualities; resistance to oil, pitch, and varnish; cut-through resistance; and a dielectric strength of 1000 v./mil average.

Mechanical Marking

DEVELOPMENT of a new combination type of fixture for holding plastic, metal, and wood parts for mechanical marking has been announced by The Acromark Co., 561 Morrell St., Elizabeth 4, N. J.

Handles, tubular parts, and gages for industry, as well as bicycle grips, operating handles, fish pole handles, etc., for the sports fields, are marked in standard reciprocating type machines when the fixture is used. Either hot or cold marking, with or without electrically heated color transfer is possible. The fixture is sold by itself or as part of an Acromark marking machine.

Chemically Inert Pump

ADDITION of a new Teflon-ceramic seal to its line of positive displacement pumps has been announced by Eco Engineering Co., 12 New York Ave., Newark, N. J. The seal, designed to broaden the applicability of the Eco stainless steel pumps beyond the range of uses of the conventional Teflon-asbestos packings, is dimensioned to fit the regular Eco pump stuffing boxes, and is available separately for use on Eco pumps.

Silicone Tape

SPECIAL silicone-treated tape, called SG-300, which is claimed to possess high dielectric strength, rigidity, and other improvements in a Class H product, has been developed by Irvington Div., Minnesota Mining & Mfg. Co., 6 Argyle Terrace, Irvington 11, N. J.

Particularly designed for the manufacture of dry-type transformers, SG-300 is also available in full 36-in. roll form or in sheets. The material can be formed around a very small radius.

Four thicknesses of SG-300 are available at present, but others are being developed. Samples and preliminary technical data may be obtained from the company.

Catalin Earnings

AT THE annual stockholders meeting held by Catalin Corp. of America, 1 Park Ave., New York 16, N. Y., Harry Krehbiel, president, stated that the company's first quarter of 1955 was one of the best in recent years.

The company earned $99,399.81, equal to 10½¢ per share on the 929,064 shares of common stock outstanding after preferred dividend requirements in the quarter ended March 31. In the same period last year, Catalin showed a net loss of $31,397.97. Sales increased to $4,285,116.06 from $3,993,569.56.

At the meeting, Henry H. Reichhold, board chairman of Reichhold Chemicals, Inc., was elected to the Catalin board to succeed the late Norvin H. Green.

EXPANSION

Monsanto Chemical Co.'s Plastics Div. and **Shawinigan Resins Corp.** announce that new multi-million dollar facilities will be constructed in Trenton, Mich., for the production of plastic for safety glass.

Shawinigan, an associate company of Monsanto, will construct facilities in Trenton to manufacture Butvar, the polyvinyl butyral resin base material. Monsanto's Plastics Div. will build separate facilities there for converting the Butvar into Saflex sheeting for safety glass manufacturers. The facilities, expected to be completed at the end of 1956, will double existing capacity for the safety glass interlayer.

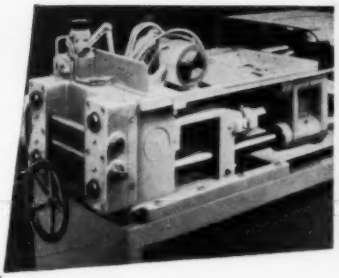
R. K. Mueller, general manager of Monsanto's Plastics Div., states: "By adding the new Saflex facilities, we will be well able to supply the automotive industry, which has forecast a 10-million car year by the end of this decade. In addition, there exists a growing need for Saflex in the export market and for television implosion plates.

"Previously, we had increased production facilities in Springfield 20% in 1953 and 50% in 1954. However, these increases will not be sufficient to meet the demand foreseeable for 1960, and therefore, the major expansion at this new location has been undertaken."

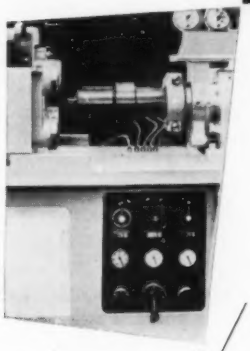
B. F. Goodrich Chemical Co. has started construction of a three-story commercial-type office building for sole occupancy by the company at 3135 Euclid Ave., Cleveland, Ohio. The building, which will be ready about May 1956, measures 90 by 147 ft. with a gross area of 52,000 sq. ft., including basement.

Texas Eastman Co., Div. of Eastman Kodak Co., announces that demand by users of products that depend on the butyl family, particularly in the field of plastics, already exceeds the original planned-for capacity of the new Longview, Texas,

Powerful toggle clamp with four tie bars, hydraulically operated



Automatic return of injection unit



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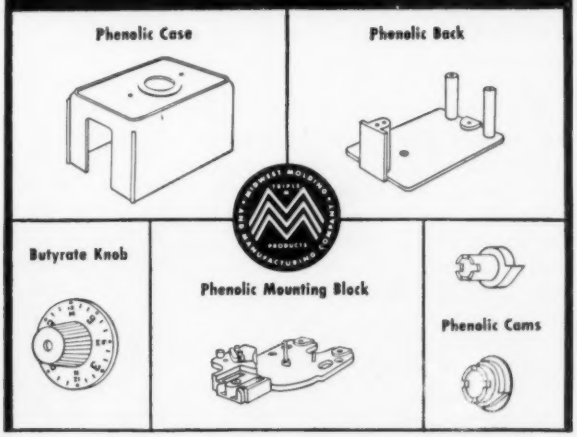

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plant. As a result, according to **James C. White**, president of Texas Eastman, an expansion of the Oxo facilities in Longview has been approved and is already under way. The increase, it is expected, will provide adequate capacity for the manufacture of butyl and derivatives, such as 2-ethyl hexanol, demand for which has outrun present capacity.

The projected facilities will permit production of other important chemicals in addition to the butyls, such as propyl aldehydes and derivatives, anyl aldehydes and derivatives, and decyl alcohols.

Provision is also being made at Texas Eastman for modification of some of the auxiliary equipment to permit rapid expansion of facilities manufacturing neopentyl glycol and trimethyl pentanediol, as demand warrants.

The new facilities at Longview are expected to be in operation by late fall of this year.

The first units of Texas Eastman's Oxo plant went into production in the spring of 1952. Utilizing propylene obtained by cracking East Texas liquefied petroleum gas, these units have been producing both N- and iso-butyraldehydes which are starting points for a number of important chemical products.

N-butyraldehyde itself is an important raw material in the manufacture of safety glass. Butyric acid, a derivative, is one of the starting points for cellulose acetate butyrate for use in films, plastics, and protective coatings. Through processing, N-butyraldehyde is converted to 2-ethyl hexanol, from which the most popular vinyl plasticizer, D.O.P., is produced.

Marblette Corp., 37-21 30th St., Long Island City 1, N. Y., has expanded its production facilities and services by adding 15,000 sq. ft. of floor space to its current plant. New sales and storage facilities in Canada have been opened. Distribution facilities have been improved in the western area of the United States. Practical assistance in plastic tooling and in the use of plastic molds in vacuum forming is now being offered by **Marble Plastic Co.**, Franklin Park, Ill., one of an augmented group of sales-engineering representatives for Marblette.

Marble Plastic Co. is headed by **Robert Kostur** and **Robert Ross**, whose background includes operation of a die shop which has been successfully making plastic tools and molds for over three years. They are currently using their experience as engineering consultants to offer users of casting resins a complete service by actually visiting plants and helping companies construct efficient tools and molds.

Archer-Daniels-Midland Co. has opened a new plant in Ashtabula, Ohio, for the production of fatty alcohols. These higher alcohols, frequently used for plasticizers in the vinyl industry, are produced from such materials as linseed, soybean, marine and sperm oils, cocoanut oil, castor, tallow, and other fats and oils. Glycerine and caustic soda will be important by-products at the new plant, which includes a tank farm with 39 storage tanks.

The Ashtabula plant will employ about 50 men. A-D-M now operates 107 plants and elevators in 21 states and Canada.

Irvington Div., Minnesota Mining & Mfg. Co., has started production in its new vinyl extruding plant at N.W. 39th Ave. and N.W. 38th Court, Miami, Fla. The plant's output will be directed chiefly to supplying weatherstripping and glazing channel shapes for metal window and jalousie manufacturers in the south, particularly in the Miami area.

The plant itself will be a branch of Irvington's Plastics Div. and will be managed by **Bernard M. Hoey**, former sales manager of the division.

Irvington was a pioneer manufacturer in developing vinyl as metal-window glazing and weatherstripping material and claims to be the chief national supplier of this product to metal window manufacturers.

Adams Plastics Co., Holyoke, Mass., a subsidiary of **Ekco Products Co.**, is planning a major production boost with acquisition of a four-story building in Holyoke. The company expects to move into the new building soon, at which time its personnel will be augmented from the current 100 to about 300 or more as new lines are added, according to **Benjamin A. Ragir**, president of Ekco. Now occupying 25,000 sq. ft. of floor space, the move will give Adams Plastics an area of 125,000 sq. feet.

The shift to larger manufacturing space was caused by the firm's entrance into the plastics housewares field and the steadily increasing demand for Flint cutlery, whose Pakkawood handles are made by Adams.

Ekco recently bought the plastics housewares division of **Kilgore, Inc.**, Westerville, Ohio, and this operation is being assigned to Adams.

Adams Plastics was founded in 1946 and acquired by Ekco last year. **George P. Alderman** heads the Adams Plastics operation as vice president and general manager.

St. Regis Paper Co.'s Panelyte Div. has acquired the assets and all equipment of **Kline Mfg. Co.'s Plastics Div.**, Galeno, Ohio. Panelyte has moved the vacuum forming and extrusion equipment of Kline's plastics department to its new vacuum forming plant in Richmond, Ind. With the development of production at the plant in Richmond, Panelyte becomes active in four major fields of plastics—high-pressure laminates, injection and compression molding, and vacuum forming.

Marbon Chemical Div., Borg-Warner Corp., Chicago 4, Ill., announces that some preliminary engineering work will be started soon in anticipation of the future development of the site recently acquired by the company at Washington, W. Va.

Robert Shattuck, president of Marbon, states that there are no plans for actual construction of a plant there in the immediate future. It is anticipated that operations in the Gary, Ind., plant will continue and the extent of any expansion would be determined by the requirements of Marbon's customers in the chemical industry.

Falls Engineering & Machine Co., Cuyahoga Falls, Ohio, announces a plant expansion program which will double the company's production, engineering, and office area. When

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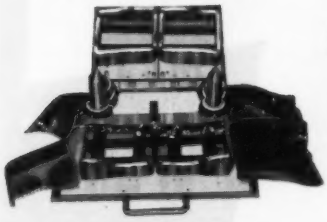

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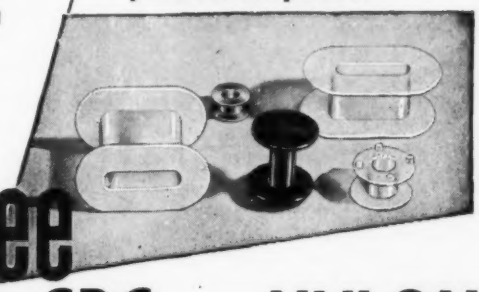

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the program is completed, Falls Engineering will have four times as much space as it had in 1945.

Included in the company's line of special machinery are splitters, cushion cutters, and roller die cutting machines which are used to fabricate such materials as synthetic and natural foam rubber, cellulose sponge, cork, resin-bonded fiber, wood fiber, and fibrous glass.

Resdel Engineering Corp., manufacturer of Electronheat dielectric heaters, has moved to new quarters with 10 times the original plant capacity. The company now occupies a 21,000-sq. ft. building at 330 South Fair Oaks Ave., Pasadena, Calif.

Resdel has effected improvements in circuit design to extend the range of materials which may be heated dielectrically. The firm is producing several models of Electronheat units for the plastics, clay pipe, and frozen foods industries and for the continuous production of extruded fibrous glass shapes.

Makray Mfg. Co., custom molders, has broken ground for the construction of a plant in Norridge, Ill., one of the new northwestern industrial suburbs adjacent to Chicago. Makray will occupy the building with **Tilemaster Corp.**, manufacturer of plastic wall tile, at the end of the year. Both companies are headed by **Paul Makray.**

Mr. Makray started with a machine shop in 1942 and subsequently entered the plastics molding business; Tilemaster began production of plastic wall tile in 1946.

National Lead Co., 111 Broadway, New York 6, N. Y., announces the formation of **Abbey Chemicals, Ltd.**, London, England. Production at Abbey Chemicals' plant in Stratford is expected to start by January 1956.

Among the products to be manufactured are stabilizers and plasticizers for vinyl plastics. Pigments and gelling agents for the paint industry and other chemicals will also be marketed by Abbey.

National Lead Co.'s subsidiary, **Hoyt Metal Co. of Great Britain, Ltd.**, owns the majority interest in the new company, with **F. W. Berk & Co.**, British chemical manufacturers, holding the remaining shares.

The sale of chemical products in continental Europe will be handled through another subsidiary, **Titan Co. A/S.**

Libbey-Owens-Ford Glass Fibers Co., Toledo, Ohio, is launching an expansion program involving expenditures of $250,000 in the next 12 months for its **Corrulux Div.** in Houston, Texas. The division manufactures fibrous glass-reinforced plastics panels for the building industry.

The program includes installation of continuous production lines designed especially for panel manufacture, extension of present buildings to house the new lines, and the complete revamping of present production equipment. When the new facilities are completed, the Corrulux plant will have a production capacity of 20-million sq. ft. of panel per year.

Permanent Label Corp. announces the opening of its new 10,000-sq. ft. plant at 49 Ackerman St., Bloomfield, N. J., set up to specialize in the printing of polyethylene bottles.

Officers of the company are **Henry T. Contreras,** in charge of sales; **Joseph P. Contreras,** general manager; and **Michael Contreras,** in charge of production and quality control.

COMPANY NOTES

Hercules Powder Co., Inc., Wilmington 99, Del., announces that **Carl W. Eurenius,** formerly director of sales of the company's Cellulose Products Dept., has been appointed assistant general manager of the department. **Warner C. Brown,** an assistant director of sales in the department, succeeds Mr. Eurenius as director of sales.

Mr. Eurenius joined Hercules' Cellulose Products Dept. in 1942 and was named product supervisor of chlorinated products in 1946; at the end of the same year, he was transferred to the sales research division as manager; and two years later Mr. Eurenius was transferred back to the Cellulose Products Dept. as director of sales. Mr. Brown joined the company as a chemist at Hercules' Experiment Station near Wilmington in 1942.

The Visking Corp., Terre Haute, Ind., announces the election of **Howard R. Medici** as president of the company, succeeding the late J. Paul Smith. Mr Medici joined Visking in 1929 as sales manager; he was named a vice president in 1933 and three years later became vice president and secretary of the company; in 1943 Mr. Medici was elected to the board of directors and by 1948 was serving as vice president and treasurer; and in 1953 he became executive vice president. Before joining Visking, Mr. Medici had been in the pencil and plastics businesses. He was a pioneer in the introduction of casein plastics to this country. During his four-year term as sales manager, Mr. Medici was influential in gaining acceptance for cellulose casings, first for "skinless" franks, then for other sausage items.

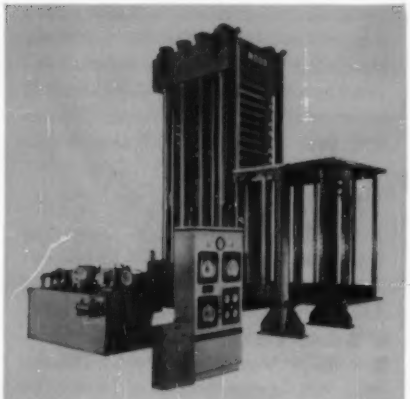
Howard R. Medici

Pending shareholders' approval on its move to increase the board's membership by one, the directors named **E. B. Cahn** general manager of Visking's **Plastics Div.** Mr. Cahn has been with the company since 1932 and has headed the Plastics Div. since 1950.

Leslie E. Houck, formerly vice president and general manager of **Visking, Ltd.**, Lindsay, Ont., a wholly owned Visking subsidiary, succeeds the late Mr. Smith as president of the Canadian firm.

Shawinigan Resins Corp., Springfield, Mass., has established a marketing department to handle polyvinyl resins. **A. W. Dunning,** former vice president of Monsanto-Kasei Chemical Co., Tokyo, Japan, will head the new department.

W. R. Elliott, vice president and general manager of Shawinigan, states that the company will soon open district sales offices in Chicago and Los Angeles. He also adds that the firm has purchased development and technical service laboratories previously operated by Shawinigan



2000-ton R. D. Wood Hydraulic Press for laminating and polishing plastics. Press has 10—4" openings, platen size 42"x83", and is of the completely self-contained type, including pumping unit for semi-automatic control of time, pressure and temperature. Press is equipped with hydraulic loading and unloading elevator. Send for complete details of this or other R. D. Wood presses for the plastics industry, without obligation

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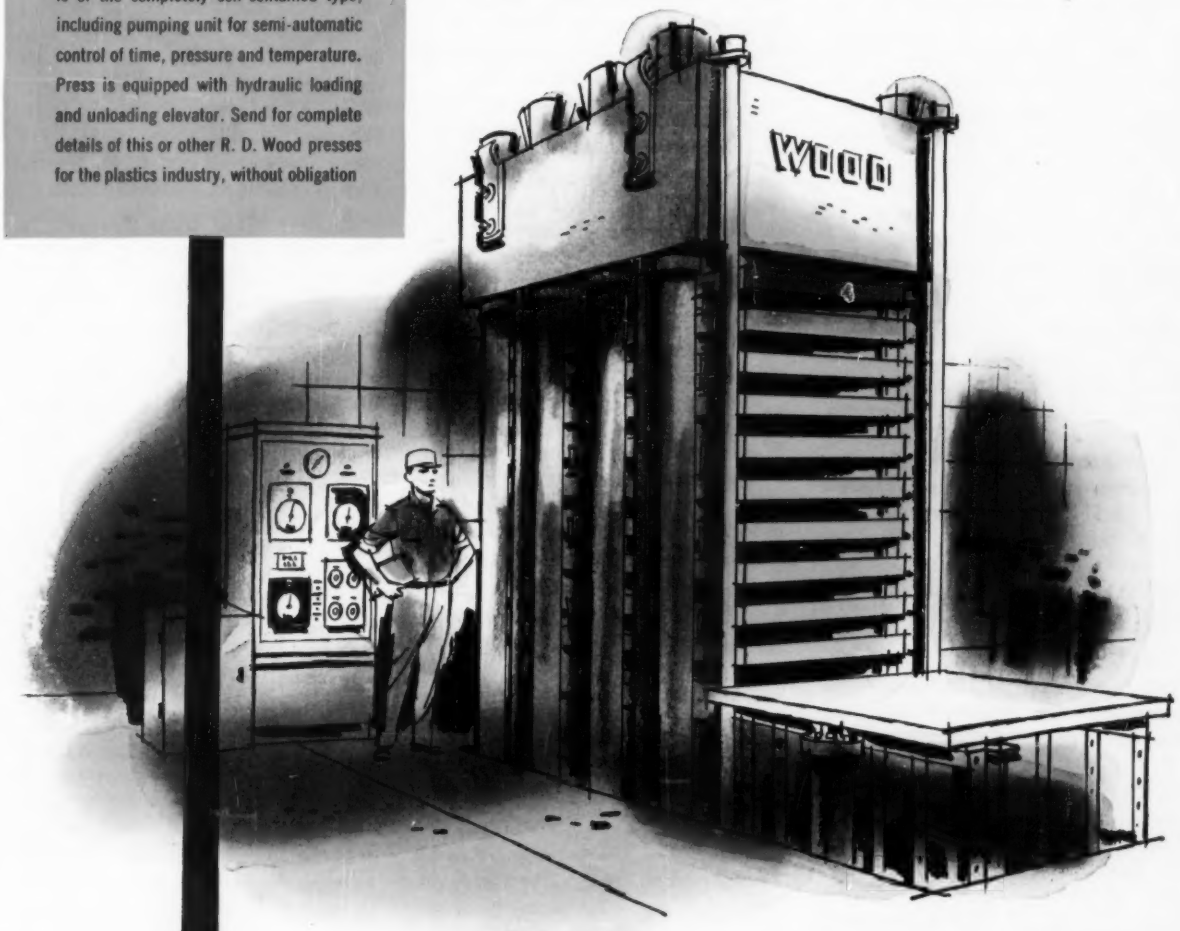

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Products Corp., Milltown, N. J. Technical personnel and laboratory equipment are being transferred to Springfield.

Until recently, the company's products were sold by Monsanto Chemical Co. and Shawinigan Products Corp., acting as sales agents. Sales personnel formerly handling the products are being transferred to Shawinigan Resins.

The Goodyear Tire & Rubber Co., Akron 16, Ohio, announces the appointment of **J. S. Bruskin** to the newly created post of manager of the **Films and Flooring Div. E. H. Dours**, manager of Goodyear's Packaging Films Dept., and **H. M. Evans**, manager of the Flooring Sales Dept., will report to Mr. Bruskin. **E. J. Dunlavy** succeeds Mr. Bruskin as manager of the Vinylfilm Sales Dept. Mr. Bruskin joined the company's Vinylfilm department in 1949 as manager.

B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, Ohio, announces that **L. R. Modlin, Jr.**, has been appointed manager of the General Chemical Sales Dept. He replaces **R. P. Kenney**, who recently became European director of chemical activities for **The B. F. Goodrich Co. J. S. Wolff**, formerly biochemical sales development manager, succeeds Mr. Modlin as field sales manager of the department.

The Dow Chemical Co., Midland, Mich., announces the following appointments: **Dr. William H. Schuette** has been named general manager of the **Midland Div.** In his new capacity he will assume administrative direction of the division. Dr. Schuette had served as assistant to the general manager since last January, prior to which time he had been plastics production manager. **Dr. Mark E. Putnam**, executive vice president of the company, who has handled the functions of division general manager, will now devote his entire attention to administrative affairs on a company-wide basis. **A. R. Tucker, Jr.**, formerly manager of Styrofoam sales in Midland, has been transferred to Dow's Los Angeles, Calif., office as supervisor of plastics sales in the Southern California area. **Robert L. Curtis**, previously supervisor of plastics sales in that area succeeds Mr. Tucker in Midland. Both Mr. Tucker and Mr. Curtis have been associated with plastics sales since joining Dow in 1946.

Acheson Dispersed Pigments Co., 2250 E. Ontario St., Philadelphia 34, Pa., announces that **Howard A. Acheson, John P. Deringer, Raymond Szymanowitz, John C. Sprague**, and **John S. Thome** were elected directors of the company at its annual meeting. Officers elected at a subsequent meeting were as follows: **Howard A. Acheson**, president; **John S. Thome**, vice president; **John C. Sprague**, secretary-treasurer; and **Nicholas J. Caggiano**, assistant secretary and assistant treasurer.

F. J. Stokes Machine Co., Philadelphia, Pa., announces that **Roger H. Watkins** has joined its Cleveland sales staff as a senior sales engineer.

The company also announces the opening of a new sales office at 27 Wellington East, Toronto, Ont. **J. William Robinson**, formerly manager of the company's Montreal office, will be in charge of the new office.

Molded Fiberglass Co., Ashtabula, Ohio, announces the following appointments: **Donald Storey**, formerly production manager, has been named vice president in charge of manufacturing; **Paul E. Sanford**, previously plant manager, is now vice president in charge of engineering; and **William R. Helm**, formerly supervisor of material preparations for Molded Fiber Glass Body Co., has been named sales manager of Molded Fiberglass Co.

Shell Chemical Corp., 50 W. 50th St., New York 20, N. Y., announces that **H. I. Wolff** has been appointed to the newly created post of assistant manager of the Manufacturing-Development Dept. He will be responsible for the coordination and guidance of plant improvement and expansion programs. **G. A. Grimma** continues as assistant manager of the department responsible for functions involving economic evaluations, research, and long-range development programs, as well as unit process and unit operations chemical engineering studies.

Hale & Kullgren, Inc., 613 E. Tallmadge Ave., Akron, Ohio, associated with **The Aetna-Standard Engineering Co.**, Pittsburgh, Pa., has named **O'Connor & Co., Inc.**, 333 No. Michigan Ave., Chicago 1, Ill., as its Western sales representative. O'Connor will handle machinery sales of the National Erie line, including extruders, presses, and mill and Banbury repair service.

Pittsburgh Coke & Chemical Co., 2023 Grant Bldg., Pittsburgh 19, Pa., announces the election of the following officers: **R. M. Marshall** was named chairman of the board; **Henry L. Hillman**, president; **J. H. Hillman, Jr.**, chairman of the Finance Committee; and **R. M. Moore**, vice president of administration.

Bigelow Fiber Glass Products, a Div. of Bigelow-Sanford Carpet Co., Inc., 140 Madison Ave., New York 16, N. Y., has appointed **Dominion Rubber Co., Ltd., Textile Div.**, 84 Margaret Ave., Kitchener, Ont., Canadian distributor of Bigelow's line of mechanical mats, Rovcloth (woven roving), and wide glass cloth. **Morley C. Preston** is manager of the Textile Div.

Art Decorating Co., 4201 Hudson Blvd., North Bergen, N. J., is the new name of the former **Art Roll Leaf Stamping Co.** as a result of a merger with **Art Marking Specialists, Inc.** Art Roll Leaf has heretofore specialized in hot-stamping of plastics and various other materials in conjunction with Art Marking Specialists, which performed the decorating on the same types of products by the silk screen process, as well as the offset printing process.

Management under the new firm remains the same—**Arthur N. Skeels**, president; **Manuel Heit**, production manager; and **George E. Davidson**, sales manager.

Fortune Plastics, Inc., Golf Links Rd., Westbrook, Conn., has been recently formed to engineer and manufacture flexible packing. Operations of the company will include extrusion, printing, and conversion of unsupported film. Fortune will

also represent manufacturers who specialize in equipment in the packing, closing, sealing, and handling of the film.

Officers of the new company are **William A. Ward, Jr.**, president; **Robert J. Clifford** and **William E. Tucker.** All three officers were affiliated with Shore Line Industries for a number of years.

Naugatuck Chemical Div., United States Rubber Co., Rockefeller Plaza, New York 20, N. Y., announces the following appointments: **Earle S. Ebers**, formerly director of research and development, has been named general sales manager of the division; **D. Lorin Schoene**, previously assistant director of research and development, succeeds Mr. Ebers as director of research and development of the division; and **F. Dudley Chittenden**, formerly manager of the division's Painesville, Ohio, plant, has been appointed production manager.

The Dow Chemical Co., Midland, Mich., has named **Atlantic Foam Products Co.**, Ipswich, Mass., as a distributor of Styrofoam (Dow expanded polystyrene) in the New England area.

Arthur M. Brink, president of Atlantic Foam, has had about 15 years executive sales, advertising, and engineering experience in the insulation, plastics, electronics, and chemical fields.

Ferro Corp., 4150 E. 56th St., Cleveland 5, Ohio, announces that **Ernest S. Felker**, formerly Southern representative handling the company's glazes and color oxides for the plastics and clayware industries in Dallas, Texas, has been promoted to the position of administrative assistant to the manager of the company's **Color Div. Jack W. Godbold** succeeds Mr. Felker as Southern representative. He was formerly associated with S. P. Ward Co., Los Angeles, Calif., as a sales engineer.

Mitchell-Bentley Corp., Owosso, Mich., announces that a group headed by its president, **Don R. Mitchell**, has purchased **Bolta-Carpart, Inc.**, an Owosso firm which manufactures custom molded plastics for the automotive, refrigeration, radio, television, and packaging industries.

Mr. Mitchell, whose Ionia Mfg. and Owosso Mfg. Divs. are suppliers of finished bodies and trim to the automotive industry, states that his group bought the interest held in Bolta-Carpart by The General Tire and Rubber Co. Mr. Mitchell's group already held all outstanding stock not owned by General Tire.

Bolta-Carpart was formed in 1952 by The Bolta Co., Lawrence, Mass., and Carpart Corp., Owosso, and since that time has been a supplier of molded plastic parts. The company specializes in decorated nameplates, medallions and horn buttons for automobiles, refrigerators, radios, television sets, and molded nylon parts.

Herb-Shelly, Inc., Farmington, Minn., subsidiary of **Brown & Bigelow Co.**, announces that **F. E. Gruber**, formerly vice president and general manager, has been appointed president of the subsidiary. **D. E. Elder**, previously general sales manager, has been appointed vice president and director. Mr. Elder joined Herb-Shelly in 1951 to help organize the company's sales department. The firm manufactures polyethylene bags and liners.

Wheelco Instruments Div., Barber-Colman Co., has moved its Chicago office to larger quarters at 6610 No. Sheridan Rd., Chicago 26, Ill.

Durez Plastics Div., Hooker Electrochemical Co., has moved its Chicago branch office to 1 No. La Salle St., Chicago 2, Ill., where the parent company's branch office is now located.

Sales representatives at Durez are **Edwin E. Woodman, Edward F. Borro, Jr., Alfred W. Wandschneider**, and **Henry B. Puff.**

Fox Valley Plastics Corp., 218 No. Broadway, Aurora, Ill., has been recently reorganized and will engage in custom work. The company has installed modern and fully automatic vacuum-drape forming equipment and offers a complete service from consulting, engineering, research, and model and mold making to complete finished products. **L. W. McDowell** is president of the firm.

Standard Machinery Co., Mystic, Conn., has sold its molding press business to a newly formed and separate company, **Hull-Standard Corp.**, Abington, Pa. Although molding presses have accounted for about 75% of Standard's business during the past 25 years, the rapid acceptance by industry of the company's plastics extruding and electrical wire insulating machinery since World War II has necessitated an expansion of that part of the operation to a point where plant facilities became inadequate. Standard has now decided to channel its efforts into the extruder and wire coating machinery field exclusively.

Kaye-Tex Mfg. Corp., 4407 So. Broad St., Yardville, N. J., announces that **Martin Rosen** has been assigned to the technical sales staff. **Leon O. Allison** succeeds Mr. Rosen as chief chemist.

Milt Grey Associates, 1000 Manhattan Place, Los Angeles, Calif., has been formed by **Milt Grey**, formerly vice president and merchandising director of Revel, Inc., Venice, Calif. The new firm will sell marketing services with salesmen in every major market. Permanent display rooms will be maintained in Chicago, New York, and Los Angeles.

Sudler Co., Los Angeles 19, Calif., an agency specializing in hobby and toy fields, will serve on the planning board and will direct the advertising division.

Bolta Products, Div. of The General Tire & Rubber Co., Lawrence, Mass., announces that **Howard W. Wing, Jr.** has been appointed sales manager of the Boltaflex Special Sheeting Div. He succeeds **J. A. Wilcox** who has been promoted to manager of Bolta's Central Sales Service.

Libbey-Owens-Ford Glass Fibers Co., Toledo, Ohio, reports that **George L. Smead** has been appointed sales manager of fibrous glass reinforced products; **Don W. Lyon**, manager of textile sales; and **Hugh W. Paul**, manager of technical sales service.

Denby Mold Co. has moved its plant and office to 13741 E. Nine Mile Rd., East Detroit, Mich.

PERSONAL

Walter J. A. Connor was elected executive vice president and a director of **American Plastics Corp.**, 342 Madison Ave., New York, N. Y., a wholly owned subsidiary of **Heyden Chemical Corp.** Mr. Connor will operate from American Plastics' executive offices in New York City. The company's principal manufacturing activities are conducted at its

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Bainbridge, N. Y., plant. The firm specializes in plastics injection molding, extrusion, casein, and reinforced plastics. Mr. Connor was formerly senior vice president and a director of Celluplastic Corp., Newark, N. J.

Gerald A. Ward has been appointed general manager of distribution of **Bakelite Co.** He will be responsible for packaging and methods of packing Bakelite plastics, order entry, distribution, warehousing, and inventories. Mr. Ward, who was previously superintendent of services at Bakelite's plant in Bound Brook, N. J., joined the company in 1925 at Carbide and Carbon Chemicals Co. in South Charleston, W. Va.

George T. Barks has been named assistant to the sales manager of **Monsanto Chemical Co.'s Plastics Div.** for Opalon vinyl resins. Mr. Barks was responsible for the development of various Opalon copolymers, including those for the flooring and phonograph record industries. He joined the division's vinyl chloride production department in 1948.

Robert J. Musser has been appointed assistant manager of the Market Research Dept., **Carbide and Carbon Chemicals Co., a Div. of Union Carbide and Carbon Corp.** Mr. Musser will assist **Dr. A. H. Tenney,** manager of the department, in surveys of future markets for established chemicals, as well as for new chemicals coming from the research laboratories.

George Rice is now assistant to **Sidney Emsig** of **Emsig Mfg. Co.,** 225 E. 60th St., New York, N. Y., producer of Permaloid plastic buttons. He will concentrate on new product sales and development. Mr. Rise was with American Cyanamid Co. for 17 years, where he was most recently product supervisor of thermosetting molding compounds.

E. Y. Wolford, manager of plastics market development, **Chemical Div., Koppers Co., Inc.,** Pittsburgh 19, Pa., was a member of a nine-man American delegation to an international plastics standardization conference held in Paris, France, from July 8 to July 13. Mr. Wolford participated in deliberations aimed at setting up international standards for testing plastic raw materials.

Paul McClay was elected an assistant vice president of **Archer-Daniels-Midland Co.,** 700 Investors Bldg., Minneapolis, Minn. He was formerly in charge of sales of the firm's New York office and six Atlantic seaboard states. Mr. McClay will continue to headquarter in New York.

Richard W. KixMiller was elected vice president in charge of **Celanese Corp. of America's Chemical Div.,** 180 Madison Ave., New York 16, N. Y. Mr. KixMiller joined the company in 1946, and in 1952 was named general manager of the division.

J. Earl Pittenger, 8100 E. Jefferson St., Detroit, Mich., has been named Midwest representative for **Deecy Products Co.,** Cambridge, Mass., producer of plasticizers used primarily by the vinyl chloride industry.

Robert A. Schoen has been appointed a sales representative of **Ansbacher-Siegle Corp.,** Rosebank, N. Y. He is slated to assist his father, **A. H. Schoen,** in the Philadelphia territory. The elder Schoen has been with the company for 34 years.

N. J. Rakas has been named director of research and development of **National Automotive Fibres, Inc.,** 19925 Hoover Ave., Detroit 5, Mich. Prior to joining National as a sales engineer in 1948, Mr. Rakas was associated with Chrysler Corp.'s engineering division.

J. E. Stokes has been appointed Midwest manager, Laminating Materials, **Bakelite Co., a Div., of Union Carbide and Carbon Corp. Mr.** Stokes will supervise sales of laminating materials in those territories serviced by Bakelite's offices in Cleveland, Detroit, Chicago, Kansas City, and Atlanta. His headquarters will be in Cleveland, Ohio.

Dr. Karl T. Zilch has been appointed to the research staff of **Emery Industries, Inc.,** Cincinnati 2, Ohio. He will be directly connected with the Fatty Acids and Esters Laboratory, under the direction of **V. J. Muckerheide.** Dr. Zilch was formerly with the Oil and Protein Div. of the Northern Utilization Research Branch, United States Dept. of Agriculture, Peoria, Ill.

Roger H. Watkins has joined the Cleveland sales staff of **F. J. Stokes Co.** as senior sales engineer. The company's district office is in the N.B.C. Bldg., Cleveland 14, Ohio.

R. K. Buffington is now sales manager of **General Plastics Corp.,** 2260 Centinela Ave., Los Angeles, Calif. Mr. Buffington was formerly assistant sales manager of U. S. Rubber Co.'s Royalite products.

G. Daniel Davis has been named executive vice president of **Nopco Chemical Co.,** Harrison, N. J. He will have full responsibility for the operation of the company's **Industrial Div.,** including sales, production, and product development.

E. C. (Chris) **Mireau** is now vice president in charge of manufacturing of **Zenith Aircraft, Div. of Zenith Plastics Co.,** Gardena, Calif.

Mark Hopkins is now sales manager of the Proprietary Div. of **Prolon Plastics, Div. of Pro-Phy-Lac-Tic Brush Co.,** Florence, Mass. He will supervise the sale of Prolon and Florence tableware, tumblers, and trays.

J. James Mudd has been named assistant manager of Field Engineers and Sales of **The Bellows Co.,** Akron 9, Ohio. Mr. Mudd will be responsible for the administration of field sales and service.

John D. Serpico has been appointed assistant manager of technical service of **Marbon Chemical Div., Borg-Warner Corp.,** Gary, Ind. Mr. Serpico was formerly affiliated with Rodic Chemical & Rubber Corp. as development manager, with Economy Faucet Co. as plant manager, and with Allis Rubber Co. as a chemist.

Arthur N. Williams has been appointed president and chief executive officer of **Haskelite Mfg. Corp.,** Grand Rapids, Mich. He succeeds **George H. Redlin,** who has been named chairman of the board. For the past 10 years, Mr. Williams was general sales manager of General American Transportation Corp.'s Plastics Div. Previously he served

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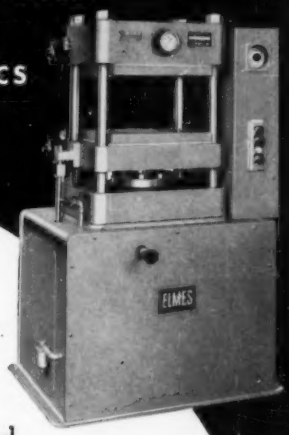

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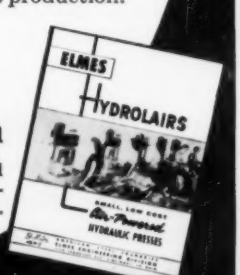

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in a similar capacity with Eclipse Mfg. Co., Milwaukee, Wis., which was acquired by General American in the postwar period as part of the company's expanding activities in the plastics field.

W. C. Walker has been named assistant to the vice president in charge of advertising and public relations of **Witco Chemical Co.**, 122 E. 42nd St., New York 17, N. Y. Mr. Walker was formerly associated with Chas. Pfizer & Co., Inc.

J. S. Stanford, formerly assistant to the president, **George E. Lewis**, has been named vice president of **Varcum Chemical Corp.**, Niagara Falls, N. Y. Mr. Stanford will continue to assist Mr. Lewis in the management of the company but will also assume a major responsibility in Varcum's expanded sales activities. Mr. Stanford's previous affiliations were with The Borden Co. as general works manager and with Monsanto Chemical Co.'s Plastics Div. as general superintendent.

Arthur L. Clements, Jr. has joined the sales engineering staff of **The Glastic Corp.**, 1823 E. 40th St., Cleveland, Ohio. Mr. Clements was formerly connected with The Lincoln Electric Co., Cleveland.

Duncan K. Law has been assigned the northern New Jersey territory for **The Stanley Chemical Co.**, a subsidiary of **The Stanley Works**, East Berlin, Conn.

Michael W. Sullivan has been appointed production manager of the **Extruded Products Div., Gering Products, Inc.**, Kenilworth, N. J.

Theodore S. Hodgins, vice president in charge of the Pacific Northwest Div. of **Reichhold Chemicals, Inc.**, has been named director of the Chemical and Rubber Div., Business and Defense Services Administration, United States Dept. of Commerce. Upon his return to Reichhold the first of next year, Mr. Hodgins will become vice president in charge of research and will have his headquarters at Reichhold's executive offices in White Plains, N. Y.

Richard J. Brown has been appointed sales promotion manager of **United States Plywood Corp.**, 55 W.

44th St., New York 36, N. Y. He replaces Howard Roeding, who has retired after 20 years with the company. Mr. Brown will work with the country's 30,000 retail lumber dealers in merchandising Weldwood plywood and allied products. His former association was as advertising and sales promotion manager of Delta Power Tool Div., Rockwell Mfg. Co.

Dr. Norman A. Skow, director of research of **Synthane Corp.**, Oaks, Pa., represented the United States at an international meeting on standards held in Paris, France, and served as secretary to the meeting on plastics of the International Organization for Standardization (ISO). The ISO is composed of the national standards bodies of 35 countries, which coordinate their standards in the interests of improving the national trade.

MEETINGS

Sept. 10-14—Screen Process Printing Association National, Seventh World Convention and Exhibit, Ambassador Hotel, Atlantic City, N. J.

Sept. 19-22—Society of Industrial Packaging and Materials Handling Engineers, Tenth Anniversary National Meeting, Kingsbridge Armory, New York, N. Y.

Oct. 1-9—Second Annual Cleveland Do-It-Yourself, Hobby, and Photo Show, Public Auditorium, Cleveland, Ohio.

Oct. 5-9—World Plastics Fair and Trade Exposition, National Guard Armory in Exposition Park, Los Angeles, Calif.

Oct. 6-8—Society of Industrial Designers, Eleventh Annual Meeting and Design Conference, The Woodner Hotel, Washington, D. C.

Oct. 13-15—Committee on Vacuum Techniques, Inc., Second Symposium on Vacuum Technology, Mellon Institute, Pittsburgh, Pa.

Nov. 8-10—Packaging Association of Canada, Fourth Canadian National Packaging Exposition and Banquet, C.N.E. Automotive Bldg., Toronto, Ont.

Nov. 27-30—American Chemical Society, Ninth National Chemical Exposition, Public Auditorium, Cleveland, Ohio.

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EXTRUDER: 1" N.R.M. with Pyrometer Control and take off conveyor with variable speed control on conveyor motor. Used very little—$650.00. FAWN PLASTICS COMPANY, INC., 2900 Hamilton Avenue, Baltimore 14, Maryland.

FOR SALE: Hobbing Press 800 Ton W.S. (2) 300 Ton W.S. Presses 20x20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen Ball & Jewell Plastic Grinders. Standard Mystic Embossing Presses, Accumulators, Pumps, Valves. Many other Presses—Send For Bulletin. No. 252 Stokes Closure Press, 700 Ton National Erie 38x38 platens, 250 Ton W&S 28x24 Platens, 113 Ton Farrel 36x36 Platens, 80 Ton Farrel 24x24 Platens. AARON MACHINERY CO., INC., 45 Crosby St., New York 12, N.Y. Tel.: WAlker 5-8300.

REED-PRENTICE 24 OUNCE Injection Molding Machine (10H-24) 6 years old. Fully equipped with 50 H.P. Motor, Wheelco instruments, timers, etc. 24,500 lb. injection pressure, 600 ton clamp, 16" opening, 30x30 die plates. Extra equipment, Glengarry weigh feeder. This machine is in very good condition and has had excellent maintenance. Available immediately. PLASTIC MOLDED PROD. CO., Chicago 30, Illinois.

FOR SALE: 1 National Erie 8½" strainer; 2 Cumberland 14" rotary choppers; 2 Ball & Jewell #1 rotary cutters; 2 Birdsboro 880 ton self-contained compression presses; 1 HPM hydro-pneumatic accumulator 200-3100#; also mills, extruders, mixers, etc. CHEMICAL & PROCESS MACHINERY CORP., 146-148 Grand Street, New York 13, N.Y.

KUX 2½" dia. single punch Preform Machine. Leominster 8 oz. Injection Molding Machine. Plastic and Rubber Equipment. Farrell 16"x48", 15"x36" and 6"x12", 2 roll mills. Mills and Calenders up to 84". New Seco 6"x12" and 6"x16" Lab. Mixing Mills and Calenders. Plastic & Rubber Extruders. Wat.-Stillman 75 ton automatic Molding Press 20"x20" platens. 200 ton Hobbing Press 18"x14" platens. HPM 200 ton 30"x48" platens. New Loomis 340 ton. 24"x56" platens. 200 ton Brunswick 21"x21" platens, 14" ram. 150 ton Bolling 20"x20" platens. Southwark 30 ton 14"x14" platens, semi-auto. Also Lab to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250#. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & single Punch Preform Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers. Plastic Grinders. Heavy duty mixers, gas boilers. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107—8th Street, Brooklyn 15, N.Y. STerling 8-1944.

FOR SALE

IMPCO VA 4-175-19 Plastic Molding Machine—IMPCO Serial S.O. 78010. Capacity: 4-oz. molding. This machine is designed for injection, compression and transfer molding any kind of plastic. Purchased 3/8/54, it has been used sparingly—less than 3 months on full-time production. It can be seen in operation if desired. Asking price: $15,000.

THE REDDY COMPANY, Inc.
P.O. Box 72, Montpelier, Vermont

FOR SALE: 3—National 10"x20", 6"x14" Two Roll Mills; 1—Baker Perkins 100 gal. S.S. double arm, jacketed Vacuum Mixer; 3—Baker Perkins 100 gal., 50 gal. jacketed double arm Mixers; 2—Stokes Rotary Preform Presses DD2, D3; 1—Stokes Model "R" single punch Preform Press; 1—Kux Model 15-25 double action Rotary Press; 2—Cumberland #0 Rotary Cutters; Also: Sifters, Cutters, Banbury Mixers, etc., partial listing; write for details; we purchase your surplus equipment; BRILL EQUIPMENT CO., 2407 Third Ave., New York 51, N. Y.

FOR SALE: (11) 75 ton record presses, complete @ $2,450, (11) new 100 ton, 10" ram, 10" stroke @ $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 @ $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 @ $1,650, (1) 50 ton complete, 18x18 @ $1,850, (1) 200 ton, 16" ram, 30x30 @ $2,450, (2) 200 ton, 16" ram, 42x42 @ $2,850, (1) 200 ton, 15" ram, 42x42 @ $2,450, (4) 250 ton, (2) 12" rams, 30x60 rebuilt @ $3,375. HYDRAULIC SAL-PRESS CO., INC., 388 Warren Street, B'klyn, N. Y.

BUTTONDEX MACHINES: Some used, others new. Bargain Prices. Reply Box 80755, Modern Plastics.

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 new R. D. Wood 500 ton embossing presses; 54"x26" platen, HYDRAULIC PRESSES: 40"x54", 36" ram, 1500 tons; 30"x26", 16" ram, 600 tons; 2—27"x27", 18" rams, 585 tons; 20"x20" 10" ram, 200 tons; 20"x20", 14" ram, 200 tons; 15"x15" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 2—19"x24" 10" rams 78 tons; 18"x18", 7" ram, 50 tons; 10—26"x26" 7" rams, 50 tons; 12"x12" 7½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x9½" 4½" rams 20 tons; 16"x16" 3½" rams, 12 tons; Carver model 150 and 6"x6". LABORATORY PRESSES: Stokes Model T, late type with drive; Stokes Model T, late type with hydraulic equalizer system and drive; Colton 5½ T with drive PREFORM PRESSES: NEW UNIVERSAL DUAL PUMPING UNITS 3—15 HP; NEW LABORATORY MILLS and CALENDERS; HPM 6" ram, 2500# pressure ACCUMULATOR; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. UNIVERSAL HYDRAULIC MACHINERY COMPANY, INC., 285 Hudson Street, New York 13, N. Y.

PUMP FOR SALE
Gould Triplex Pump, Size 2x8, Fig. 1841 Maximum pressure 4000 psi, Capacity 24 gpm. With V Belt Drive but no Motor. All in Excellent Condition.
DIEMOLDING CORPORATION
Canastota New York

FOR SALE: 200 T. HPM Fastraverse 84"x60" Pl. Fiberglass press & Williams & Turner Preformers. Injection Presses: 4, 8, 12, 16, 24 & 32 oz. Reeds, 2, 4 & 9 oz. HPM, 8 & 12 oz. Lesters. 4 oz. Lewis (Makray). 1 & 2 oz. VanDorn, 1 oz. Vertical Pacemaker. Scrapgrinders, Ovens, Meridian Temperature Circulator. Compression Presses: 50, 100, 150, 600 tons incl. Stokes Standard. 15 t. Stokes Automatics. Preform presses. 25 HP Mears Kane Gasboiler. 30 HP oilheat. Cyclotherm Boiler. Autovac Vacuumform. machine 52"x30". List your surplus equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: One R. H. WINDSOR Extruder RC 200 triple screw compounder extrusion machine, serial No. 173364. We have the original blueprint, instruction book, etc. Reply Box 81955, Modern Plastics.

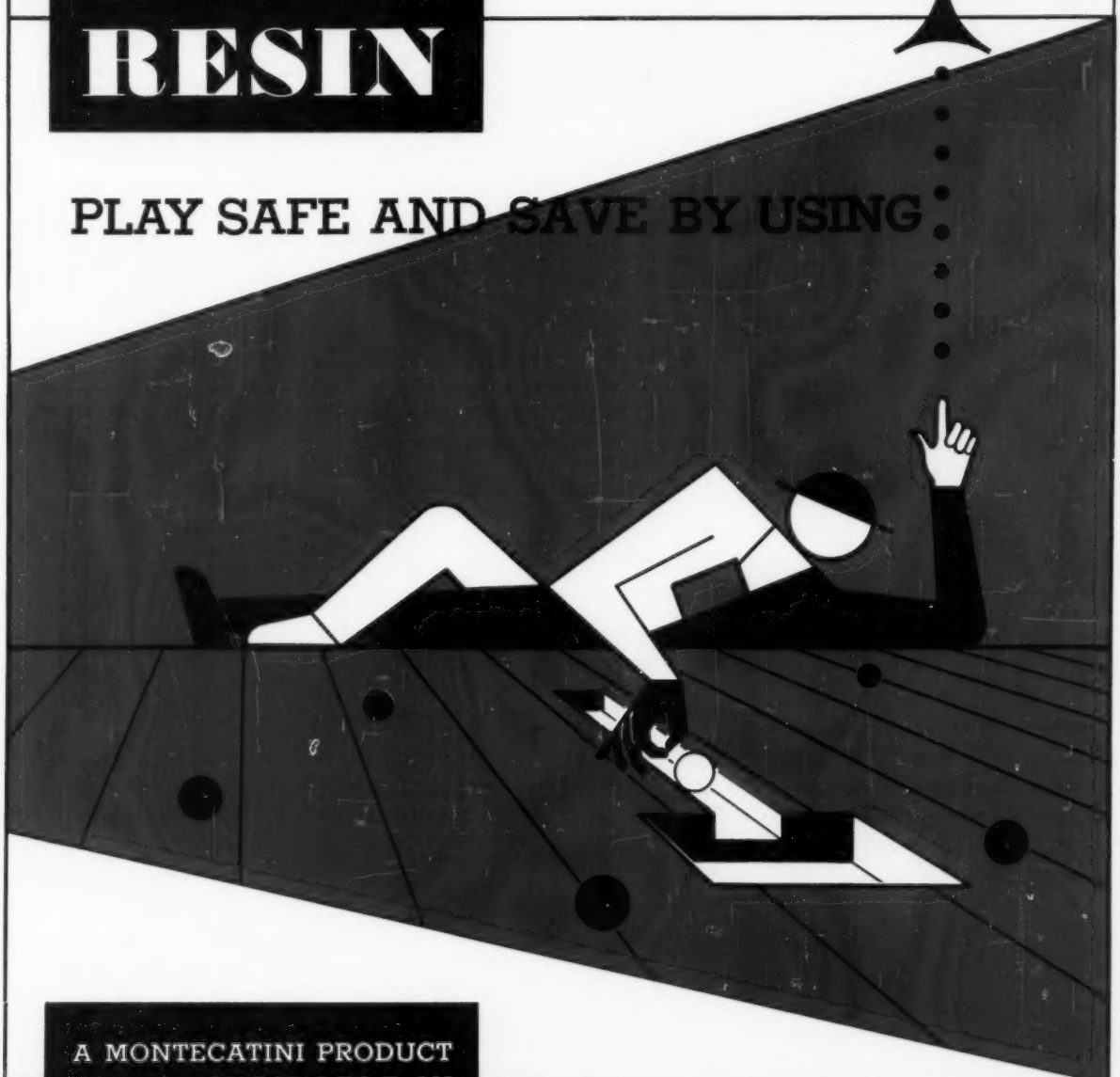
SURPLUS EQUIPMENT FOR SALE
2 Ball & Jewell Scrap Grinders, #1, 24" complete. 1 Erie Engine Two Roll Mill, 22"x60", complete with 200 H.P. Drive. 1 Thropp Two Roll Mill, 18"x40", complete with 50 H.P. Drive. 5 Screws for 4½" Hartig Extruder. Also, Belt Conveyors, Mixers and Tumblers. AMERICAN MOLDING POWDER AND CHEMICAL CORP., 703 Bedford Ave., Brooklyn 6, N. Y.

(*Continued on page 248*)

PVC RESIN

vipla

PLAY SAFE AND SAVE BY USING



A MONTECATINI PRODUCT
. . . . . AVAILABLE IN VARIOUS GRADES FOR ALL APPLICATIONS . . . . . PROMPT DELIVERY FROM STOCK IN U.S.A. & CANADA

CHEMORE CORPORATION
21 WEST STREET, NEW YORK 6, N. Y.
TEL.: HA 2-5275

u. Torricelli

CLASSIFIED ADVERTISING

(*Continued from page 246*)

FOR SALE: 1—Royle #4 Extruder, motor driven; 1—6"x12" Laboratory Mill, m.d.; 1—Ball & Jewell Rotary Cutter, size O m.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers; 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrell-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #2th, with motor; 4—Reed Prentice & W-S Injection Molding Machines, 2-16 oz.; Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? CONSOLIDATED PRODUCTS CO., INC., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425, N.Y. Tel.: BArclay 7-0600.

FOR SALE: Blaw-Knox 15 gallon Resin Kettle Pilot Plant, type 347 stainless steel, jacketed and agitated, 150# pressure with Condenser and Receiver, Variable speed drive, Controls, etc. Excellent condition. Also #1½ B & J Stainless Steel Cutter and 2—Kux Model 25 Rotary Presses. PERRY EQUIPMENT CORP., 1429 North 6th Street, Philadelphia 22, Pa.

AVAILABLE AT BARGAIN PRICES

Mitts & Merrill 15CD Rotary Cutter. J. H. Day, from ¾ up to 100 gal., Imperial and Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Baker Perkins Heavy Duty (Steam Jacketed) Double Arm, from 5 to 200 gal., Mixers (Unidor and Vacuum also). Gemco 2000 lbs. 56 cu. ft. Double Cone Blender. Mikro Bantam, 1SH, 2TH, 3W, 3TH, 4TH Pulverizers. Day, Rotex, Tyler Hum-mer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2RP and 3 RP Rotary & #5½ Tablet Machines. Carver Laboratory 20 ton hydraulic Press. Package Machy. FA, FA2, FA4, U4, Miller, Hayssen, Wrap-King, Scandia, Oliver Auto. Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machy. requirements. UNION STANDARD EQUIPMENT CO., 318-322 Lafayette St., New York 12, N. Y.

FOR SALE: Stainless Steel Rotary Dryer. Link Belt Co., 5'2"x16". No. 502-16, with all auxiliary equipment. Roto louvre also 6'x24' and 5'x26'. Hersey Stainless Steel Rotary Driers. Reply Box 82655, Modern Plastics.

MACHINERY and EQUIPMENT WANTED

INTERESTED IN PURCHASING late type 12 ounce Lester 48 ounce 60 ounce HPM Injection Molding Machines. Advise complete particulars. Reply Box 83055, Modern Plastics.

WANTED: A small bench or laboratory plastics extruder, 1 inch or less. Also a Cumberland "O" Plastic Scrap Granulator. Advise complete details with electrical characteristics. Reply Box 83555, Modern Plastics.

WANTED: We need a good used plastics pelletizing machine to be used in conjunction with mill compounding set-up. Advise make, size of motor, condition, price, etc. THE BLANE CORPORATION, Canton, Massachusetts.

WANTED: One 2" and one 3½" Thermoplastic Extruders preferably with high nickel alloy liner and screw with variable drive and motor. SARAN LINED PIPE COMPANY, 2415 Burdette, Ferndale 20, Michigan.

WANTED: Inspection Conveyor for selecting buttons. Apply to P.O. Box 461, Mexico 1, D. F., Mexico.

ELECTRONIC QUILTER

Must conform to following: at least 56" press opening with hydraulic system: At least 20 KW output, with controls: presently in operating condition. Communicate in strict confidence. Reply Box 82955, Modern Plastics.

MATERIALS FOR SALE

FOR SALE: 20,000 lbs. each Red and Blue Styrene Pellets. Sunplus lot Red Acetate Pellets—15,000 lbs. Both attractively priced. We are also in the market for all surplus plastic scrap and powder. PLASTIC MOLDING POWDERS, INC., 2004 MacDonald Avenue, Bklyn., N. Y. Tel.: ES 5-7943.

QUANTITIES EBONITE POWDER for disposal. Samples available on request. RIST'S WIRES & CABLES LTD., Lower Milehouse Lane, Newcastle, Staffs, England.

SPECIAL OFFERING

Virgin Tenite I, Color Group II—007A-18269-S Bright Red; 007A-20547-S Bright Yellow; 007A-22145-S Bright Blue; 007A-23992-MS Crystal Clear. 10,000 lbs. of each. Also Polyethylene, reprocessed pellets, at low prices. Black—Colors—Natural.

HIGH IMPACT POLYSTYRENE: You can save money by using our reprocessed High Impact Polystyrene pellets available in a variety of bright colors as well as matched colors. A. BAMBERGER CORPORATION, 703 Bedford Avenue, Brooklyn, N. Y. Telephone MAin 5-7450.

MATERIALS WANTED

We specialize in SAVING YOU MONEY! Your surplus virgin inventories are worth more when you work with us. We will sell your virgin molding powders on a sales fee basis, which means YOU receive a maximum recovery of your original costs. START SAVING TODAY. Send inquiries to GEM CITY TRADING, P.O. Box 941, Dayton, Ohio. Tel.: HE 2121.

WANTED: PLASTIC SCRAP. Polyethylene, Polystyrene, Acetate, Acrylics, Butyrate, Nylon, Vinyl. GEORGE WOLOCH, INC., 82 Beaver St., New York 5, N.Y.

SCRAP PLASTICS: All forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers and other plastic and chemical materials. ACETO CHEMICAL CO., INC., 40-40A Lawrence St., Flushing 54, N. Y. INdependence 1-4100.

INTERESTED IN PURCHASING short runs of extruded PVC tubing to meet Government specifications, in various sizes and colors. F. D. PACE CO., Box 126, Grand Rapids, Michigan.

WANTED: Plastics Scrap and Rejects of all kinds, ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.

A. BAMBERGER CORPORATION
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

WANTED: Plexiglas and Lucite scrap, salvage and cut-offs, any quantity. DUKE PLASTICS CORP., 584 Broadway, Brooklyn 6, N. Y. Tel.: EVergreen 8-5520. Note new address!

CLEAR ACRYLIC MOLDING POWDER SCRAP wanted by end user either reground or unground. Also nylon molding powder scrap needed. Highest cash prices paid. Reply Box 80555, Modern Plastics.

MOLDS FOR SALE

FOR SALE OR EXPORT: Metal drape and vacuum forming shell molds of Xmas items for illuminated displays. Santas (all sizes), sleighs, candles, angels, reindeer, candy canes, bells, etc. All for half of original cost. Also many other molds in stock for novelties, etc. Reply Box 84055, Modern Plastics.

MOLDS WANTED

WE WILL PURCHASE OR RENT for not less than six months injection molds in good condition for South American market, especially Uruguay, Brazil and Argentina. Offers with samples, size of molds, number of prints, prices—for the following items: toys, novelties, advertizing goods, kitchen and household utensils, brushes, stationery, school furniture. Wanted also exploitation of patents, licenses, close cooperation with foreign firms.

ALLALEMDJIAN & POSER
251 West 30th St., NYC

PLANTS FOR SALE

FOR SALE

Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 83855, Modern Plastics.

INJECTION MOLDING PLANT in Midwest making over $100,000.00 per year. 11 Molding machines and complete Tool-room. Reply Box 81555, Modern Plastics.

HELP WANTED

CHEMICAL ENGINEER WITH POLYETHYLENE EXPERIENCE

Must be thoroughly acquainted with sales possibilities of polyethylene molding compounds and qualified to set up the service facilities essential to the successful marketing of these materials by a leading chemical company. Send complete resume including education, experience and salary desired. Reply Box 82455, Modern Plastics.

SHEET EXTRUSION VACUUM FORMING ASSISTANT PLANT SUPERINTENDENT: A new corporation in a new modern plant in the Chicago area. Applicant should have experience in impact polystyrene sheet extrusion and/or vacuum forming with a high degree of mechanical aptitude. This is a permanent position with a good salary and an excellent opportunity for further advancement. Reply Box 81755, Modern Plastics.

CHEMICAL ENGINEER

Excellent opportunity for a young chemical engineer to grow with an expanding mid-western firm. We prefer a man with an advanced degree who has exceptional drive and enthusiasm. We can offer a good starting salary and challenging work in research and development dealing mostly with reinforced plastics, rubber compounds, adhesives, and materials application. Please submit resume and salary requirements to: Personnel Manager, THE BRUNSWICK-BALKE-COLLENDER COMPANY, Muskegon, Michigan.

(*Continued on page 250*)

Look what's happened to laundry tubs!...

Vibrin

With modern basements being used for dens, play rooms, and party areas, even the lowly laundry tub has finally gotten a "new look"...a *Vibrin* "look"!

Lighter! This new tub of reinforced VIBRIN polyester weighs only about *1/10th as much* as conventional laundry tubs—is easier and less costly to ship and install as a stationary unit—even allows mounting on a *mobile base!*

More attractive! Beautiful pastel shades are *molded right in*...can't fade, chip, or scratch off. Party designs, too, can be molded into these double-duty home fixtures—just right for storing ice cubes and cold beverages.

Extremely durable! The tough reinforced VIBRIN is actually *stronger than steel* for its weight—won't dent, rust, chip, warp, crack, or craze! Of course, it's unharmed by soaps, detergents, starches, bleaches, boiling water, and such agents normally encountered in household use.

What's more, its smooth *non-porous* surface can't harbor dirt or germ-life. It's *completely sanitary,* complying with the latest sanitary codes.

Yes, the same thing has happened to *laundry tubs* that has happened to *sport-car bodies, luggage, furniture, bath tubs, pipe, paneling, aircraft radomes, fishing rods, and many* of today's truly modern products. They've been *made* modern with VIBRIN.

Better investigate Vibrin. And look for VIBRIN in *other* products. It's a sure sign of modern quality.

Laundry tubs of Naugatuck VIBRIN® by Gray-Wilson Corp., Detroit, Mich., molded by Waterbury Companies, Waterbury, Conn. and Camfield Fiber Glass Plastics, Inc., Grand Haven, Mich.

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York • Philadelphia • IN CANADA: Naugatuck Chemicals, Elmira, Ontario
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N. Y.

CLASSIFIED ADVERTISING

(*Continued from page 248*)

PILOT PLANT CHEMIST familiar with polymerization of gases at relatively high pressures, analytical work, polymer chemistry and production experience and techniques desirable for new plant located in the middle west. Write fully regarding education, experience and salary expected in sufficient detail. Reply Box 80855, Modern Plastics.

PLANT MANAGER

We are seeking a matured Factory Executive—35-45 years old—to administer all of the factory operations includ.ng Production, Engineering, Production Control Methods, and Maintenance Standards Will report directly to the President. He should be a Chemical or Mechanical Engineering Graduate or Practical Equivalent, and have at least five years' experience as top factory executive in an organization employing from 150 to 200 people in the plastic industry—compounding, extruding, and allied operations. The desired person must have heavy engineering experience in the plastic field to direct closely the program of improving present products and have the ability to develop new ones. Location—New Jersey area. Indicate availability for interview. Send complete resume and salary requirement to Box 81255, Modern Plastics.

INJECTION MOLDING SALES EXECUTIVE: Large, well-known Midwest custom molder, separating injection from compression sales, offers unusual opportunity to man qualified to manage injection sales. Prefer executive experience, both sales and engineering. Write full details, including salary, to Box 83155, Modern Plastics.

DESIGN ENGINEERS AND DETAILERS

Old reliable concern, Western Pennsylvania, has openings for mechanical and hydraulic heavy equipment designers and detailers. High salary, good opportunity for advancement and excellent working conditions. Reply Box 80955, Modern Plastics.

OPPORTUNITY WITH PROFIT SHARING: We are expanding and have openings for experienced men in the following departments: (1) Extrusion foreman—General extrusion or sheet extrusion experience necessary. Be capable of setting up job and handling people. (2) Injection Molding Foremen. Capable of setting molds, establishing cycles, handling people. Painting, cementing and assembly experience helpful. (3) Vacuum Foremen—Experience in techniques, tools and the handling of various materials. (4) Junior Engineer familiar with injection molding operations, blue print reading, calculation of volume, to be trained as an estimator. These jobs are key positions. You are coming in on ground floor of recent expansion. Salary depends on past experience. Located Richmond, Virginia. Send complete information including past experience and salary requirements to Box 81655, Modern Plastics.

VINYL COLOR MATCHER

Require man experienced in color matching and production color control in film and sheeting. Reply Box 82855, Modern Plastics.

SALES ENGINEER: Familiar with markets for extruded shapes and other flexible plastic extrusions. Knowledge of markets for rigid extrusions desirable. Well-known company establishing new line of plastic extrusions. Eastern location. Favorable working conditions. When replying state your qualifications fully. Box 83355, Modern Plastics.

SELLING OPPORTUNITY

Midwest Mfr. of Vacuum Forming Machines seeking representation for most midwest states. Give full details first letter. Reply Box 82055, Modern Plastics.

EXPERIENCED PLASTIC SHEETING SALESMAN

Splendid opportunity with very reliable, established organization, manufacturing an extensive and varied line of sheet materials. Salesman must be proficient in handling sheeting of .005 gauge and over. Send complete resume, your photograph and territory covered. All information will be held confidential. Reply Box 81355, Modern Plastics.

PLASTIC DEPARTMENT SUPERVISOR wanted for Investment Casting plant in Ohio. Must be thoroughly familiar with tooling, set-up etc. Write qualifications to box 81855, Modern Plastics.

MATERIAL SALESMEN

We have openings for experienced plastics materials salesmen in several territories. Activities include sale of Virgin and Reprocessed molding powders and buying of scrap and surplus molding powders. Send complete resume and state salary requirements. All replies held in strict confidence. A. BAMBERGER CORPORATION, 703 Bedford Ave., Brooklyn 6, N. Y.

PLASTICS ENGINEER with administrative experience as assistant to owner of small, rapidly growing plastics plant—fabrication and reinforced plastics—in N.Y.C. Must be able to assume responsibility, handle purchasing, production control and customer contacts. Excellent opportunity for ambitious, capable hard worker with technical background. Write fully to Box 82555, Modern Plastics.

EPOXY PLASTICS
TECHNICAL SERVICE LABORATORY

Devoe & Raynolds, THE PIONEERS IN THE EPOXY RESIN FIELD, is diversifying by expanding its activities to include the field of laminating, potting, tooling, adhesives, etc. A new well-equipped laboratory unit is being established to take advantage of our broad and basic experience in epoxy resins. This new laboratory requires key personnel to form the nucleus of this group and grow with us in this expansion program.

DIRECTOR PLASTICS TECHNICAL SERVICE LABORATORY: Should have broad experience in a number of the plastics field such as tooling, adhesives, potting, or laminating, etc. and have ability to supervise the operation of this well-equipped laboratory.

COMPOUNDER: Two years' minimum experience required in compounding epoxy plastics for various applications.

These positions offer unusual opportunities with new laboratory divisions of company well known for its achievements in the field of epoxy resins. Salaries open. Forward resume of experience and education to C. M. Jackson, Coordinator Technical Division, DEVOE & RAYNOLDS COMPANY, INC., Box 328, Louisville 1, Kentucky.

CHEMIST: Experienced in compounding for extrusion of plastics shapes including polyvinyl chloride. Must be familiar with production problems and techniques. Well-known company establishing new line of production. Eastern location. Very favorable working conditions. Reply in confidence to Box 83455, Modern Plastics.

SALES REPRESENTATIVE to work directly for expanding organization: Chemist or Chemical Engineer with at least 2 years Vinyl extrusion experience, for sales of Polyvinyl Chloride Resin in the midwest. Will be fine opportunity for right man. Furnish personal information, experience and salary desired. M. L. Hurr, Personnel Manager, THE GENERAL TIRE & RUBBER COMPANY, Akron, Ohio.

ENGINEERS — SALESMEN — ADMINISTRATORS — EMPLOYERS: Confidential, rapid and professional service for nation wide placement in the Plastics field. Write giving age, education and brief experience. Employers send us job description. We will let you know how we can help you by return mail. GRAEBNER'S PLASTICS EXCHANGE "The Nation's Largest", 116 South Michigan, Chicago 3, Illinois.

CAPABLE SALES REPRESENTATIVES with plastic machinery experience wanted to handle sales of the foremost Vacuum Forming Machinery Manufacturer. Protected territories available in the South, Southwest, Northwest, and some Eastern Areas. Reply Box 82155, Modern Plastics.

FLOOR TILE CHEMIST WANTED

Experienced manufacture Vinyl Tile. Good salary, liberal insurance, hospitalization and retirement. Replies will be confidential. Reply Box 80155, Modern Plastics.

LARGE NEW ENGLAND INJECTION MOLDER with exceptionally fine tool shop is looking for first class mold designer. Some one thoroughly familiar with all types of injection molds. Position is at present vacant. Please let us have resume with salary expectations with your first letter. Also telephone number if possible. Reply Box 80655, Modern Plastics.

VINYL CHEMIST

Experienced heavy or light gauge calendering. Good salary, liberal insurance, hospitalization and retirement. Replies treated confidentially. Reply Box 80055, Modern Plastics.

CHEMICAL ENGINEER OR CHEMIST

Engineer with several years experience working in the field of glass reinforced moldings and laminates. Must be thoroughly familiar with all types of resins and filler systems. Will be engaged in development of new materials and fabricating techniques and will be required to work with an aggressive competent group of Engineers and Technicians. Experience with the requirements of the electrical industry helpful. Salary open. All replies held strictly confidential. Send complete resume including present salary to Dr. G. C. Gainer, WESTINGHOUSE ELECTRIC CORPORATION, Materials Engineering Department, East Pittsburgh, Pennsylvania.

CHEMIST—VINYL COATING: Require chemist experienced plastisol formulations for fabric coating operation. Good opportunity. All replies confidential. Our employees know about this ad. Reply Box 80255, Modern Plastics.

SITUATIONS WANTED

INDUSTRIAL MOLDING SALESMAN: Thoroughly experienced all thermoplastics, especially nylon. Experienced all phases of industrial molding, engineering, estimating, sales engineering, sales literature, materials applications, customer service. Accustomed handling engineering problems with top personnel. Wish to sell for experienced industrial molder (especially nylon) covering New York, New Jersey, Connecticut, Pennsylvania on salary plus commission basis. Reply Box 82255, Modern Plastics.

CREATIVE SALES ENGINEER: Custom molding—M.E.—can offer intensive 11 year background in Injection Sales Development, Plant Management, Product and Mold Design. Desires to specialize in creative sales in the East. Can assume leadership of existing department and aggressively develop new accounts and ideas both proprietary and custom. Salary and commission or draw against commission. Reply Box 84155, Modern Plastics.

REINFORCED PLASTICS ENGINEER: M.I.T. Graduate—age 31—7 years experience supervising and engineering reinforced plastics production wants broader opportunity with progressive concern. Fully experienced in bag-molding, hand layups, Marco molding, fiberglass mat making, laminating with fiberglass mat and press molding. Have successfully developed, engineered, built and managed operation of semi-automatic manufacturing processes. Reply Box 81155, Modern Plastics.

INDUSTRIAL ENG.: B.S.—age 30—4 years diversified plastic experience in all depts. Compression and Injection molding, as Foreman and Indl. Eng. Handled reorganization of small plant (not plastics) for AAA company successfully completed. Started Vacuum molding operation for small plant. Managed sheet fabrication plant doing Vacuum pressure drawing, folding, cementing, etc. Reply Box 83955, Modern Plastics.

(*Continued on page 251*)

CLASSIFIED ADVERTISING

(*Continued from page 250*)

SALES AGENTS WANTED

PACKAGING SALESMEN: AA-1 Company needs commission representatives to sell custom packaging to industrial users. We heat seal, sew and form plastic vinyl and other materials. Wonderful future and opportunity. State territory coverage. Box 1051, REAL-SERVICE, 110 W. 34 St., N.Y.C.

MANUFACTURERS AGENT OPPORTUNITY: Pressure sensitive industrial tape line. Exclusive territories open. List current territory, lines carried, and biography. Reply Box 81055, Modern Plastics.

MANUFACTURERS' REPRESENTATIVES WANTED by Eastern plastics extruder to sell vinyl and polyethylene extrusions on a commission basis. Most territories open. Reply giving present lines and territory wanted to Box 82355, Modern Plastics.

MISCELLANEOUS

TROPHY BASES, EXTRUDED TUBES, ORNAMENTS: Large trophy manufacturer interested in large quantities. If you have proprietary molds or can supply parts now being used in other fields, kindly contact us. ONYX ART CREATORS, INC., 641 Lexington Ave., Brooklyn 21, N. Y.

ATTENTION
Plastic Manufacturers In
GERMANY—ENGLAND—ITALY

America's largest manufacturer of plastic hobby kits, internationally known under the REVELL trademark, seeks arrangement with one sound financially responsible plastics company in each of the three countries mentioned. Owner will be in Europe during September to negotiate. Write giving complete details of your company: Plant description including number and sizes of machines, toolmaking facilities, history of company, products made, methods of sales distribution, financial structure, etc.

REVELL, INC.
4223 Ocean Park Avenue
Venice, California, USA

HAVE AVAILABLE small active extrusion plant, desire to combine with working partner who has active plastic extrusion, injection molding or allied plastic process business. Or will consider working partner with small investment. Must have extensive knowledge and experience in any of the aforementioned fields. I have available one new 3¼" plastic extrusion machine, misc. equipment, tool room, active accounts, 10 years experience and excellent business credit rating. I intend relocating in N. Y. Metropolitan area or Westchester County only. Replies considered confidential. Reply Box 80355, Modern Plastics.

BABY ITEMS: Wanted to buy, assemble and sell. We have nationwide distribution in this field. Reply Box 83255, Modern Plastics.

ACCOUNT WANTED
Eastern sales agency now handling plastic and rubber machinery wishes to expand into heavy chemical processing and control equipment. Especially qualified for intricate organic processes requiring skillful technical presentation. Small staff now selling over $500,000.00 annually for one customer. For confidential interview, please write Box 83755, Modern Plastics.

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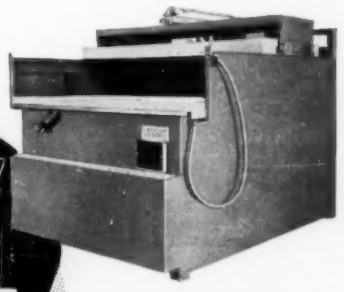

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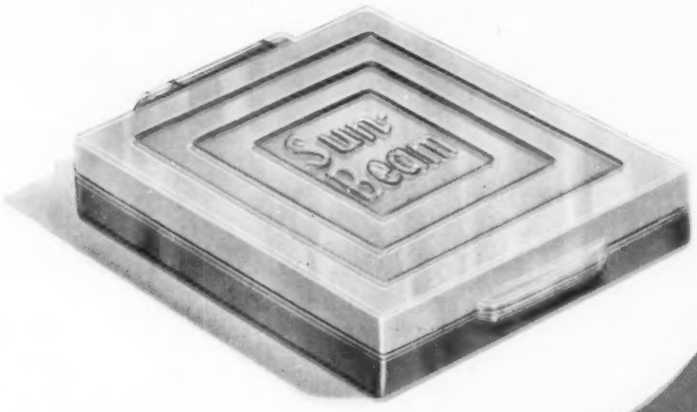

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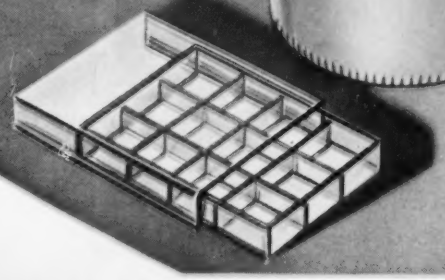

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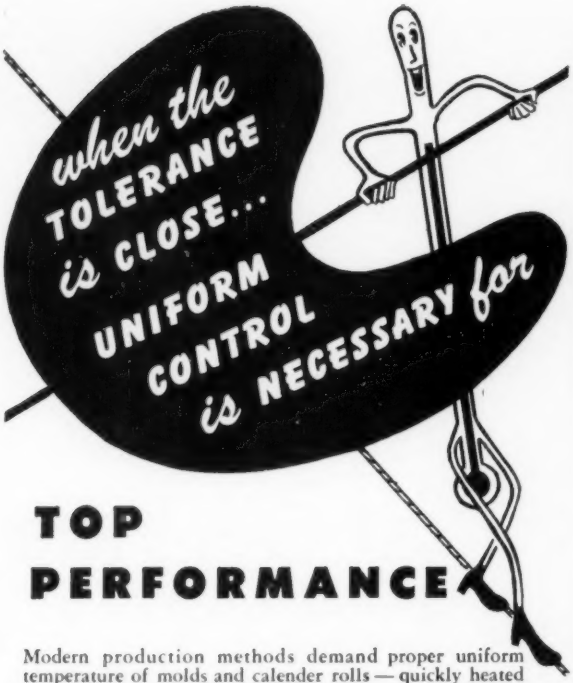

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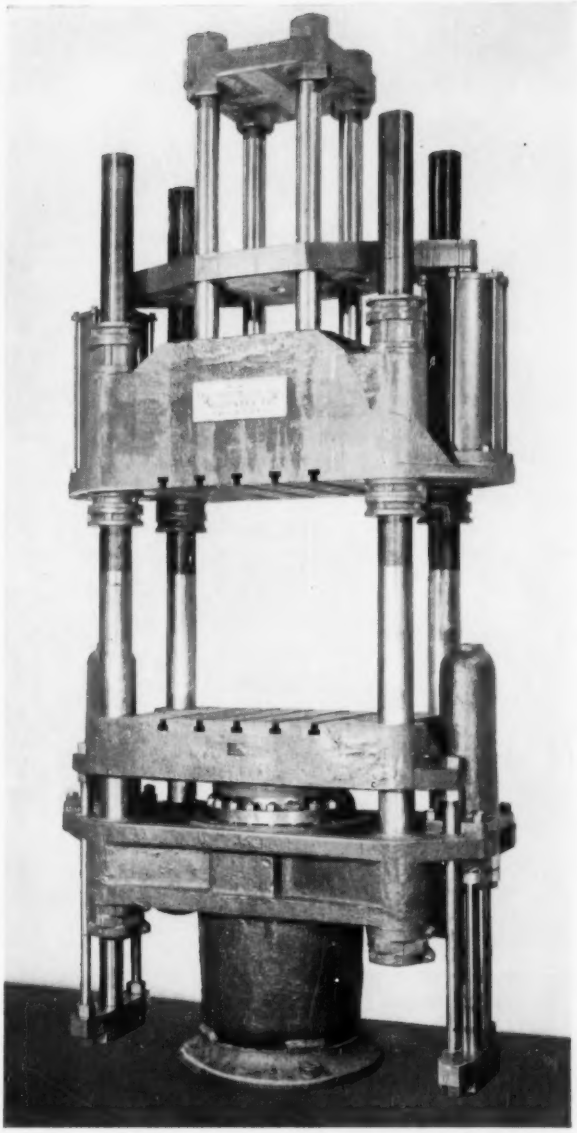

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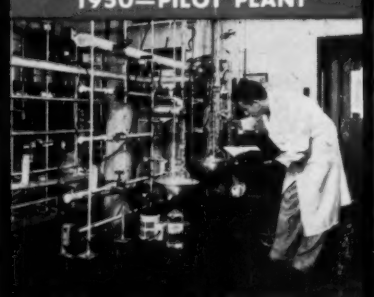

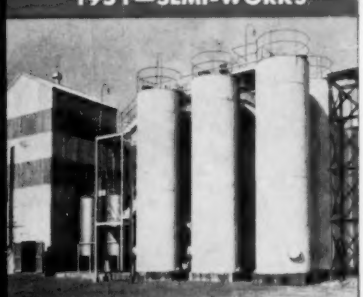

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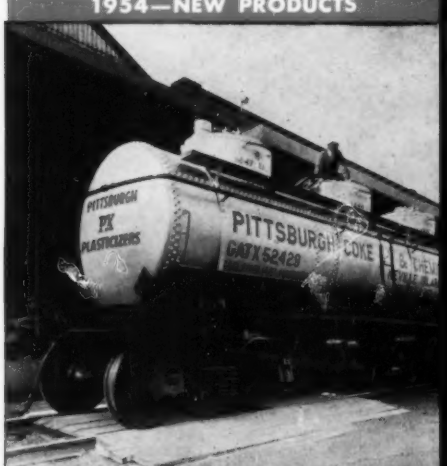

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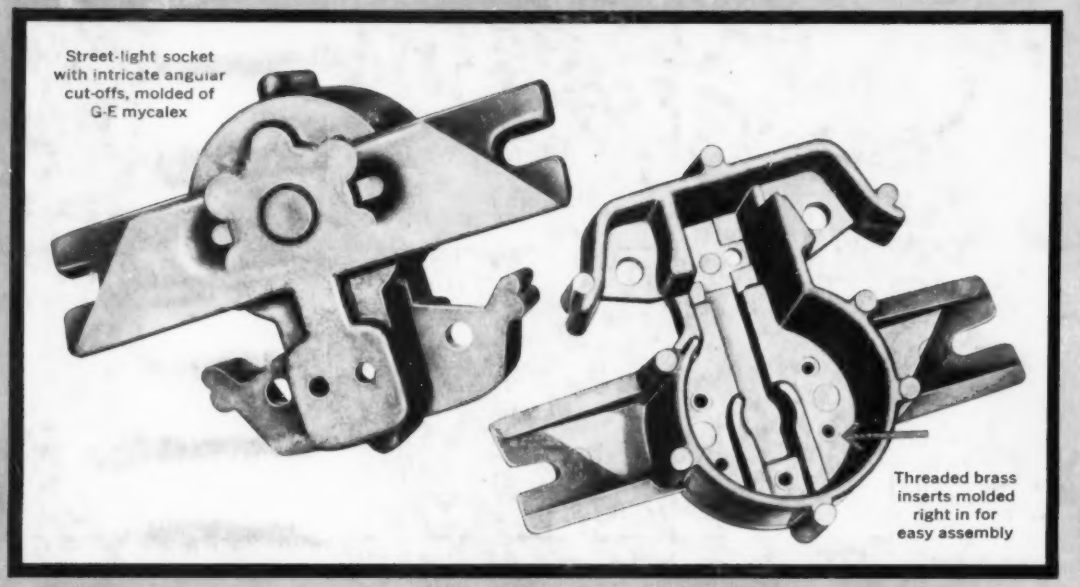
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